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Index to Advertisers and Classified Index Following Reading Matter.

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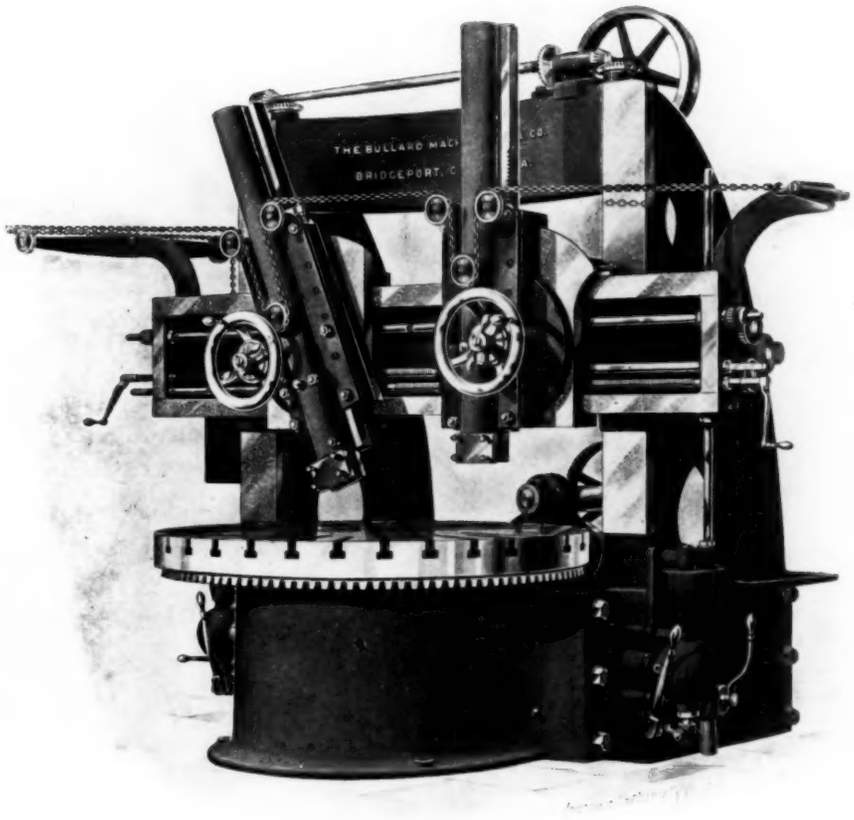

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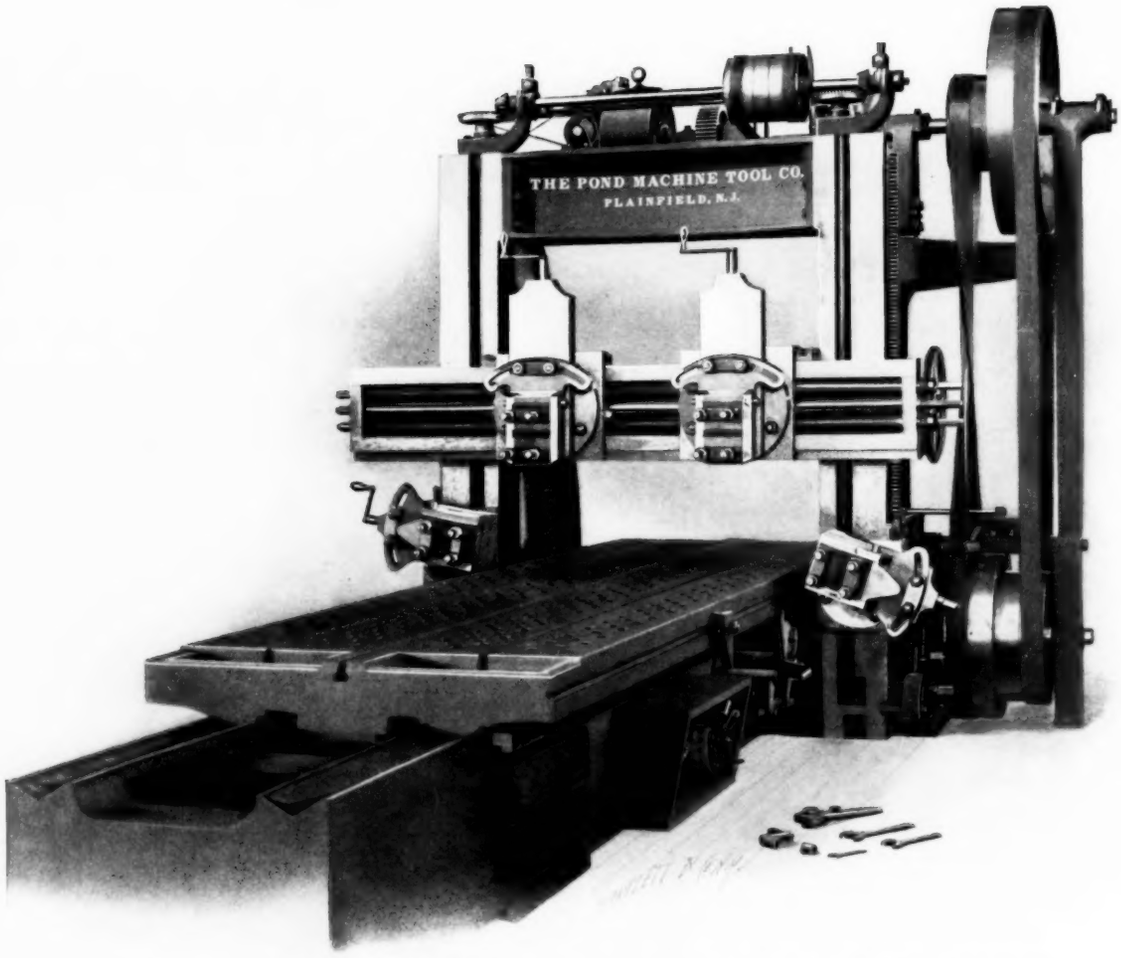

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Catching Threads in Screw Cutting—Old Patented Devices.

BY HOWARD A. COOMBS.

Since reading Mr. Osborne's graphic account of how the machinist "fooled" the foreman by throwing out and in when cutting an 11½ thread, I have wondered why no one had devised an attachment to go on the lathe carriage to obviate the necessity for the chalk marks and the close attention. To carry out the methods described in the communications on this subject requires considerable "smartness," especially with an odd number of threads. It is trying on one's nerves to have to watch marks on moving parts and to be ready to act when the marks reach certain positions, and after having repeated the operation many times it is not unlikely that one would slip up once in a while and spoil the thread or break the tool. So it occurred to me that it would be a good thing to eliminate the personal element if possible, so as to make the operation sure without depending upon the care and watchfulness of the operator.

In Mr. Lang's device the notched disk *H* is on the worm wheel shaft, and the lever *L*, which raises and lowers the half nut, engages the notches, so that the nut cannot be closed on the thread unless one of the notches is in position for the short end of the lever to enter it. This provides therefore a safeguard against accidentally throwing in at the wrong time.

When the tool is cutting, the worm wheel does not turn, because, being mounted on the carriage, it is carried along at the same rate as the nut, and is itself, in effect, a nut. But when the carriage is run back by hand, the screw acts upon the worm wheel both as a rack and as a worm to rotate it, and when the carriage has been run back far enough to bring the tool a little beyond the end of the work, and is stationary, the screw still acts upon the worm wheel to turn it at a slow rate of speed, which would make it easy to watch the indicator and throw in at the right time. With Mr. Lang's device, however, all that the workman has to do when the carriage has been run back is to press

Now, in order to have the indicator properly "indicate" the moment, it is of course necessary to have a certain proportion between the number of teeth in the worm wheel, the marks or points on the indicator and the pitch of the lead screw. If there are six points on the indicator, then we want one of them to reach the stationary index finger every time the lead screw makes four revolutions. It is understood that one of them was in that position at the moment when the feed was thrown in for the first cut. So that four turns of the lead screw must only turn the worm wheel one-sixth of a revolution, and consequently there must be twenty-four teeth on the worm wheel.

With this arrangement any screw having a whole number of threads to the inch can be cut, because four turns of the lead screw cause the tool to travel one inch, and as at the end of each inch of travel the work must have made a certain number of complete turns, the hands are in the same relative position at the end of every four complete revolutions of the lead

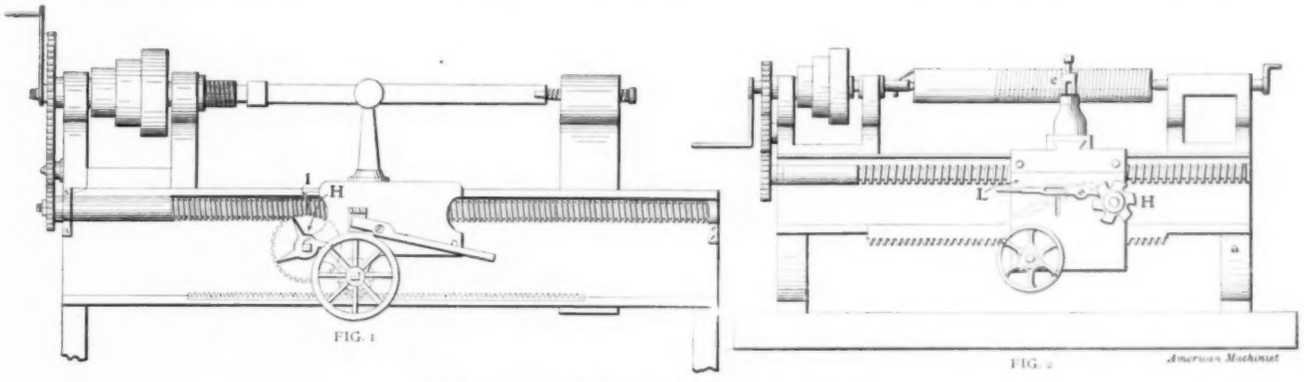


FIG. 1 FIG. 2

OLD PATENTED DEVICES FOR CATCHING THREADS.

Before, however, attempting to scheme out a rigging that would enable one to throw out and in without any worry, I thought I might as well find out whether possibly someone had not forestalled me. I succeeded in finding it out all right, and indeed discovered that not one person only, but quite a respectable number had taken out patents, one at least of which dates back to war times.

The principle upon which the patented devices work is well disclosed by two of the earliest that I have come across and as the monopoly on these two has long since run out, and anyone who cares to do so is free to make and use them, I will merely describe those. They are illustrated in the accompanying two drawings, Fig. 1 being from an 1864 patent to John G. Baker, of Philadelphia, and Fig. 2 from an 1868 patent to J. P. T. Lang, of Washington, D. C.

Mr. Baker's device is simply a substitute for the chalk marks, *H* being an indicator which is read from the stationary index finger *I*. On the same shaft as the indicator is a worm wheel meshing with the threads of the lead screw.

up on the lever, and as soon as a notch comes round in position, the lever will be free to move and close the nut.

The object in both cases is to indicate the moment at which the lead screw and the piece on which the thread is being cut occupy the same position as they did when the feed was thrown in for the first cut. The term " same position" in this connection means same relative position, which, when the pitch of the lead screw and that of the thread being cut are different, occurs only at intervals. If the lead screw has four threads to the inch and the thread being cut has three, when the lead screw has made one turn, the work has made only three-quarters of a turn; when the lead screw has made two, the work has made one and a half, and when the lead screw has made four complete turns then the work has made three complete turns. Therefore, every time the lead screw feeds the carriage along one inch, or turns sufficiently to feed it that distance if the nut were in, the lead screw and work occupy the same relative positions, and if the feed is thrown in at that moment the thread will be "caught."

screw, which in this case is equivalent to one-sixth revolution of the indicator.

Now, if a screw having a fractional number of threads is to be cut, one of the parts must be changed. Obviously, the indicator is the easiest to change. Suppose we wish to cut four and a half threads to the inch. Evidently, the lead screw and work won't come into the same position as they started in until the lead screw has made eight complete turns, when the work will have made nine turns. In other words, the end of each cycle of relative positions corresponds to two inches travel of the tool instead of one inch—that is, to two inches of the lead screw, and the worm wheel must turn through twice as long an arc at it did before in order to bring a mark on the indicator opposite the inside finger.

If the thread to be cut were 3⅓ pitch, the distance between the marks would have to correspond to 3 inches of the lead screw, because the parts would only occupy the original positions after the lead screw had made twelve turns when the work would have made eleven. Only two indicator marks or notches would be required.

Supposing such an odd pitch as 2⅕ were to be cut: then the lead screw would make 20 turns and the work 11 between the times at which they would be in the same relative positions. So the worm wheel would have to have 20 teeth or some multiple of 20. If 20, then only one indicator mark or notch would be required; if 40, two, and so on; by using one with 120 teeth the indicator having 6 marks could be used.

While this subject is not at all complicated, it seems to me to be one which is rather confusing and hard to grasp, especially for one unaccustomed to figuring out problems, and therefore I trust that the above rather detailed explanation is not superfluous and that it will be helpful to some readers of the AMERICAN MACHINIST, who perhaps had their interest in the subject first aroused, as I did, by reading Mr. Osborne's and Mr. Giddings' letters.

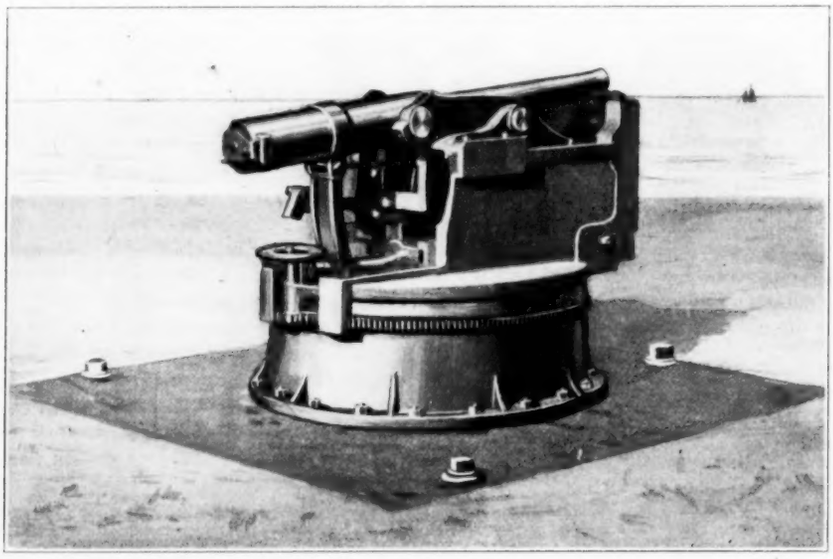


FIG. 1. 10-INCH B. L. RIFLE, DISAPPEARING CARRIAGE—LOADING POSITION.

The 16″ Army Gun Nears Completion.

It will be remembered that in the AMERICAN MACHINIST of April 9, 1896, a very full illustrated account was given of a lathe built by the Pond Machine Tool Company for turning and boring 16-inch guns. There was also in the same number an article by Antony Victorin describing the methods of work pursued at Watervliet Arsenal in making such guns. These two articles and the engravings accompanying them cover so much of the ground pertaining to the great 16-inch gun that there remains little to be said of it, now that the first of these monsters is nearing completion. Nevertheless, the accompanying photographs will undoubtedly be of interest to the readers, as they illustrate the largest and most powerful weapon ever built.

Figs. 1 and 2 are photographs showing a model of the 16-inch B. L. rifle, one-tenth actual size, and a model carriage to the same scale, also manufactured at the army gun factory, for the purpose of making preliminary tests.

The base plate of the gun carriage (when gun and carriage are in service) rests upon a foundation of concrete and is firmly secured by anchor bolts; it is also, of course, to be protected by a parapet, over which the gun is fired—this latter not appearing in the photographs.

Fig. 1 shows the gun in loading position, the counterpoise being held in a fixed position, after firing, by means of a pawl and ratchet; when released it permits the counterpoise to descend, hence the gun is raised to the firing position as shown in Fig. 2. During this action the trunnions of the gun describe part of a cycloid curve, while the trunnions of the two levers supporting the gun have a rectilinear motion parallel to the top of the chassis or rail.

Fig. 3 shows the gun in the army gun factory with its trunnions in a vertical position (the muzzle pointing toward the headstock of the lathe), suspended by the slings as shown, which are attached to a 150-ton electric traveling crane. Being thus suspended enables the gun to be swung around and reversed end for end in the lathe to do the finish boring. On top of the gun is Mr. Hugh Smith, one of the foremen in the seacoast gun shop.

The foreground of Fig. 4 shows a group of completed B. L. mortars, and the upper portion of a shrinkage pit, containing cooling appliances, oil and high-pressure steam furnaces, where parts constituting the guns of large calibers are heated until the requisite expansion has been attained for shrinkage fits. The arsenal freight locomotive appears in the middle ground. In the background will be seen a large number of guns under construction. It also gives an interior south view of the seacoast gun shop, which is 1,000 feet long, the south wing 150 feet wide and the north wing 130 feet wide.

In the foreground of Fig. 5 will be seen the gun in the boring and turning lathe, the breech end of the gun being held in the face-plate chuck jaws, while the gun is also supported at other points by steady-rests.

The 16-inch B. L. rifle will be equipped with the "Stockett system" breech mechanism, an improvement and modification of the "Farcot-Fletcher system." By this improved mechanism the object is to apply power to one crank only; and by its rotation in one direction, the rotation, extraction and swinging of the breech block are accomplished; whereas in older-style mechanism three separate and distinct motions are necessary for performing the same functions, the latter involving considerable loss of time and complication in mechanism. The Stockett system has been adopted and used on all modern B. L. rifles of various calibers.

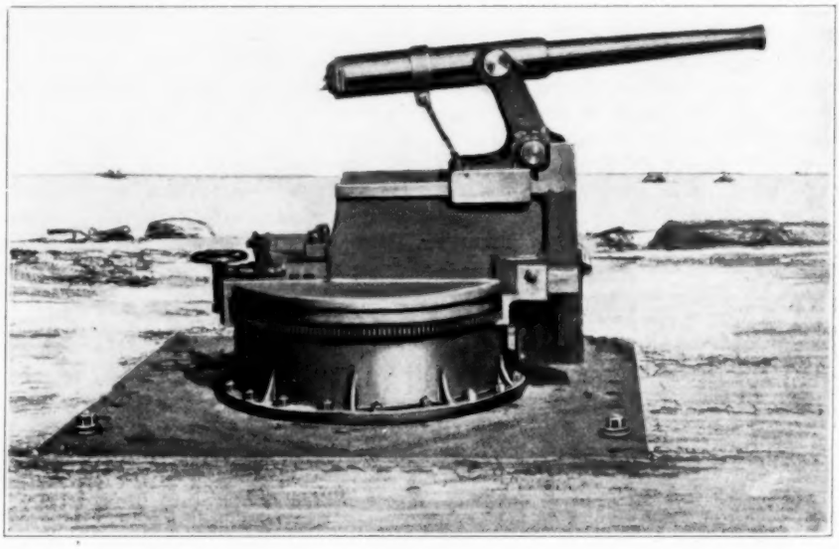


FIG. 2. 16-INCH B. L. RIFLE, DISAPPEARING CARRIAGE—FIRING POSITION.

GENERAL DIMENSIONS OF THE GUN.

This gun weighs 130 tons according to

estimation; its total length is 49 feet 2.9 inches (590.9 inches). The external breech diameter is 60 inches, diminishing to 28 inches at the muzzle. The main bore is 37 feet 4.5 inches (448.5 inches) long by 16 inches in diameter; distance across the trunnions, 7 feet 6.5 inches (90.5 inches); volume of powder chamber, 29,385 cubic inches.

Regarding the exterior ballistics, it may be of interest to note the enormous range, which, as calculated by Maj. James M. Ingalls, U. S. A., equals 20.978 miles, or practically 21 miles. The range and energy depend of course upon the quality and amount of powder used; the gun requires 576 pounds of smokeless powder, or 1,176 pounds of black powder; it is proposed, however, to use the former kind. With a maximum powder pressure of between 37,000 and 38,000 pounds per square inch (and 88,000 foot-tons muzzle energy), it is estimated that this gun will throw a projectile weighing 2,370 pounds (5 feet 4 inches in length) with a muzzle velocity of 2,300 feet per second to correspond with above-stated range.

The extreme altitude of the trajectory would equal 30,516 feet; the gun must necessarily have the proper angle of elevation to meet the required conditions.

The above-stated energy would give a penetration in steel of 42.3 inches at the muzzle, according to De Marre's formula, with normal impact.. When the gun is ready for shipment, it will be sent to Sandy Hook proving ground for tests. The permanent location of the gun has not as yet been determined.

The only government army gun in the country at Watervliet Arsenal, aside from work on the 16-inch breech-loading rifle, manufacture the large army seacoast, field and siege guns; this most important work demands the utmost accuracy and skill in workmanship, besides the application of modern methods and appliances for executing these essential requirements.

The commanding officer of the Watervliet Arsenal is Colonel J. P. Farley, of the Ordnance Department, U. S. A., assisted by officers of the same department and Alfred Christiansen, M. E., master mechanic (member of the American Society of Mechanical Engineers).

JOHN M. B. SCHEELE.

West Troy, N. Y.

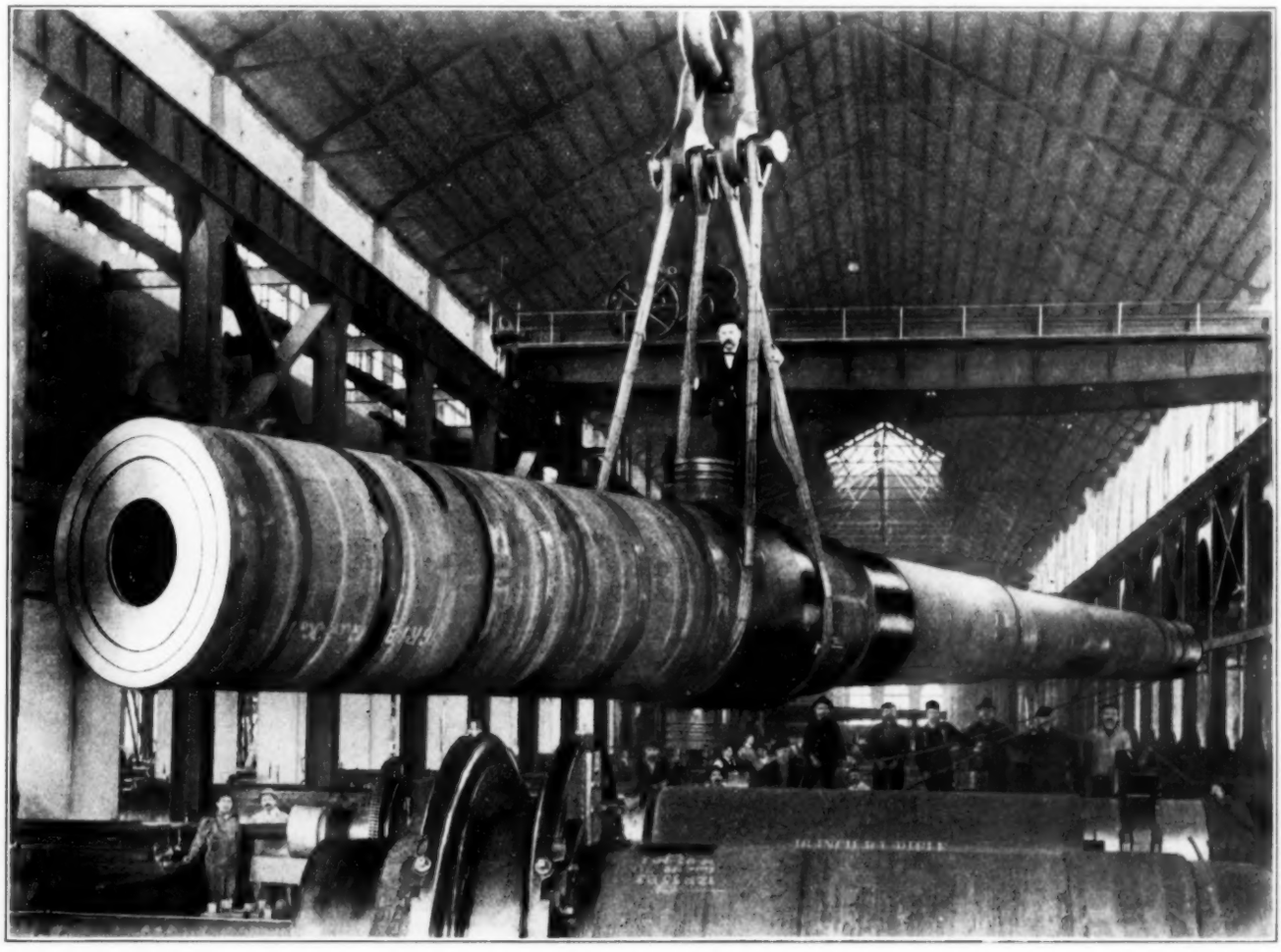


FIG. 3. 16-INCH GUN BEING REVERSED IN THE LATHE.

Machinery at the World's Fair, St. Louis—Some New Features.

We have received advance proofs of a publication issued by the department of machinery of the World's Fair at St. Louis. Thomas M. Moore is chief of this department, and he has, it seems, adopted some novel features.

For one thing, no charge is to be made for space, and to a reasonable extent, power, light and such facilities as may be necessary for an exhibitor to make a proper presentation of his machinery will be furnished absolutely free. Not only this, but the Exposition Company will endeavor to make the most favorable freight arrangements possible with the transportation lines, and will place railway tracks to and within the principal exhibit buildings, furnish cranes and hoists when necessary and in general do whatever may be found proper for the convenience of exhibitors, and to protect them against the extortions (which are too common in exhibitions) by carting and transfer companies, installation agencies and the like. It is pointed out that it is possible to do this partly because the St. Louis Exposition is by far the most generously endowed exposition which has ever been held. The United States Government has appropriated $5,000,000 for it, and did so only after satisfactory proof had been furnished that the Exposition Company had itself raised $10,000,000 for inaugurating and carrying forward the enterprise. This places at the disposal of the Exposition

Company a fund of $15,000,000 with which to carry on the enterprise.

In order that arrangements may be made for assignment of space, location of aisles, etc., Mr. Moore desires to correspond, as soon as possible, with exhibitors of machinery, and blank forms for application for space may be had now upon request. It is especially desired that those who think of taking part in the Exposition shall apply for such forms, and that they shall inform Mr. Moore, as soon as possible, how much space will probably be required. It may be also that machine tools will have a building devoted exclusively to them, though we believe the possibility of arranging for this has not been fully determined.

Classification in the department of machinery is somewhat novel, and we give it herewith in full:

MACHINERY—DEPARTMENT E.

GROUP 62—STEAM ENGINES.

Class 393—Appliances for boiler feeding, fuel economizers, steam jacketing, anti-scaling compounds, methods of purification of water. Feed water heaters, steam dryers, superheaters. Oil extractors.

Class 394—Boilers, stationary, semi-stationary, or portable: steam gages; packings and fittings for boilers. Chimneys for boilers. Smoke consumers.

Class 395—Transmission of steam; joints, valves, traps, separators, condensers; and cocks, piping and systems.

Class 396—Engines, stationary, portable and semi-portable. Military traction engines. Valve gear. Condensers. Regulators and governors. Apparatus for lubrication.

Class 397—Engines moved by vapors other than steam.

Class 398—Methods of testing and registering steam: apparatus.

GROUP 63—VARIOUS MOTORS.

Class 399—Engines operated by heated air, gas, petroleum, compressed or rarefied air, ammonia, carbonic acid gas. Parts or fittings for such machines.

Class 400—Hydraulic motors, wheels, turbines, water pressure engines, etc.

Class 401—Windmills and wind motors.

Class 402—Horse powers; tumblers, spring, counterweight and pedal motors, etc.

GROUP 64—GENERAL MACHINERY.

Class 403—Apparatus for the transmission of power, shafting, hangers, pedestals, guides, gears, clutches, pawls, and systems.

Class 404—Pulleys, belts, cables and links for the transmission of power. Funicular systems.

Class 405—Governors and speed regulators.

Class 406—Lubricators, lubricants and systems.

Class 407—Apparatus for measuring the work of machines, counters, recorders, speed indicators, dynamometers, pressure gages.

Class 408—Weighing machines. Testing machines. Meters for water or gas.

Class 409—Machines for moving heavy bodies, cranes, lifts, etc.

Class 410—Machines for raising water hand or steam pumps, norias, hydraulic rams, etc. Machines for sinking wells.

Class 411—Fire engines and apparatus used by firemen.

Class 412—Hydraulic presses and accumulators.

Class 413—Water pipes and accessories.

Class 414—Air and gas compressors and pipes.

Class 415—Ventilators and blowers and systems.

Class 416—Transmission and distribution of power at a distance by means of water, steam, air or vacuum.

FIG. 4. VIEW IN GUN SHOP AT WATERVLIET ARSENAL.

Class 417—Apparatus and associations for the prevention of accidents by machinery.

Class 418—Marine and deep water machinery, diving bells, diving apparatus.

GROUP 65—MACHINE TOOLS.

Class 419—For working in metal: machines working by shock, compression or tension; steam hammers, trip hammers, drop-forging and swaging machines; machines for cutting, shearing, punching, stamping, countersinking and shaping; rolls, draw benches, wire-drawing machines; machines and presses for stretching, flanging, etc.; machines for bending, butting and welding; for riveting, for working plates (cutting, bending, rolling, edging, etc.). Methods of heating, annealing, tempering, cementing, welding, and brazing in ordinary use. Tools used with the forge and with the above-named machines; anvils, beaked anvils, vises, hammers, shears, punches, dies, etc.; various compounds for metal tempering, welding and cleaning.

Class 420—Machines with cutting tools; lathes; machinery for drilling, boring, reaming and tapping; screw and bolt cutters, machines for planing, milling, slotting, grooving, etc. Drills, taps, dies, cutters, reamers, chucks and special tools and accessories.

Class 421—Machines which have as tools such substances as grit, emery or diamond; machines to grind, polish, sharpen; dressers. Grindstones, emery grinders, tools of carborundum and diamond. Accessories of these machines.

Class 422—Equipment and tools for hand work; vises, files, graving tools, taps and dies, screw plates, etc.

Class 423—Methods and equipment for setting out work, adjusting, checking and testing; measuring tools and instruments of precision and for testing shapes and dimensions. Machine and forge-shop equipments.

Class 424—For working in wood: Saws for felling trees, dividing into logs, and appliances for trimming, handling and working timber. Machines for working lumber; for sawing, planing, turning, boring, molding, mortising, tongueing, grooving, tenoning, shaping, and carving and copying; for bending and pressing; for sanding and polishing; for veneer-cutting and veneering. Nailing and wooden-box and basketmaking machinery.

Class 425—Machine and hand tools especially fitted for working in wood. Knives, tools and appliances for woodworking machinery. Machine fittings.

Class 426—Various machine tools not included in any other classification.

GROUP 66—ARSENAL TOOLS.

Class 427—Special machinery and tools used in the manufacture of arms for military and civilian use; arsenal tools; machines for forging and straightening barrels, special lathes for instantaneous reproductions, machines for finishing the interior boring of barrels, boring machines machines for punching gun barrels, special machines for making wooden gun stocks; milling machines, machines for reproducing different parts of arms in steel machines for polishing and finishing tempering pieces, materials and tools for manufacture of cartridges and ammunition for both military and sportsmen's uses.

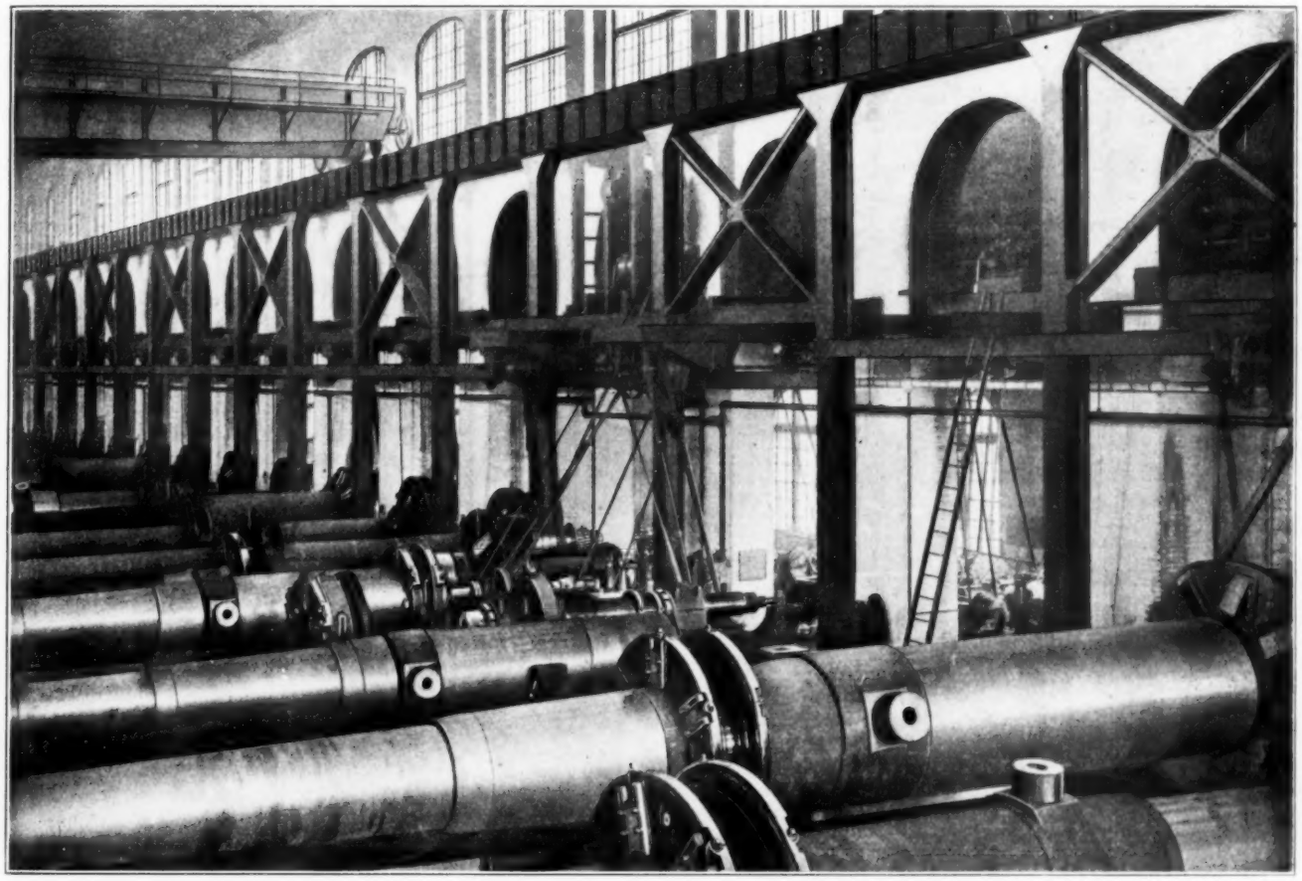


FIG. 5. 16-INCH GUN IN THE LATHE.

Stopping Off and Saving Pattern Work

BY JOHN M. RICHARDSON.

The term "stopping off," as used in the pattern shop, means that some part or parts appearing on the pattern itself are not to be reproduced in the casting. An understanding of this principle of stopping off will often save a number of dollars in the pattern shop, when a special job is required similar to some pattern already made, and yet unlike it in some particular. Quite often the expense of a new pattern is saved by a little study along this line. It is my purpose to illustrate a few cases, beginning with the simplest and leading up to one or two a little more difficult.

The part of a pattern to be stopped off may be either some supplementary portion used for strengthening or other purposes, or it may be some part of the pattern it-

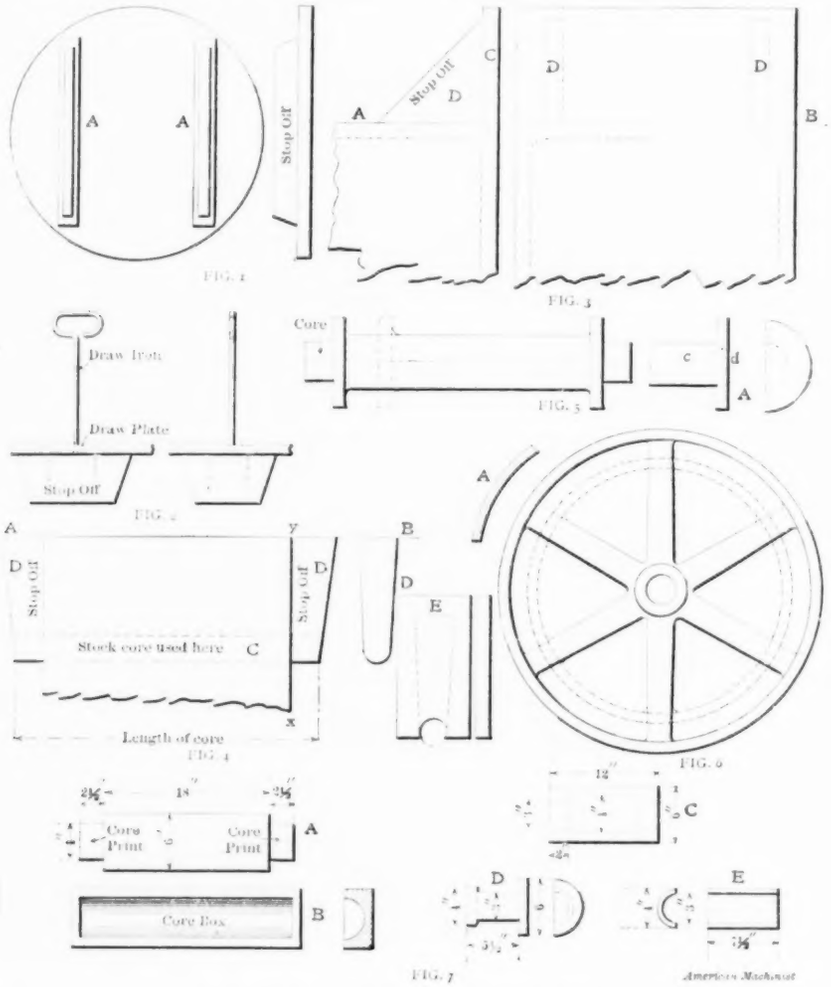
self; but, in all cases, the term implies a filling up of some part of the mold as made by the pattern, which is the real "stopping off."

The very simplest examples possible are those where some part of the mold is filled up level, as indicated by patterns in Figs. 1 and 2. The first figure illustrates a thin pattern requiring battens to hold it in shape. The second is thin work also, but it has a stop-off block, to accommodate good-sized screws for holding the draw plate. It is perfectly plain that any hub or boss on a pattern can be left off the casting in this manner.

Different pattern shops have different signs to indicate to the molder what is to be stopped off. Some paint the part a different color, some cross hatch the part with parallel lines in another color with the shellac brush, others simply paint the words "Stop Off" on the part, while still others will cross line the part with chalk. Chalk is very commonly used where the part to be stopped off is some part of a regular pattern and only used once in this special manner.

Fig. 3 is an example of a pattern to be parted on the line *A B* and having a thin piece *C* on the cope side attached with dowels. If it were not for the stop-off brackets *D* to steady the piece, it would be sure to be rammed out of place in molding. It will be seen that the cavities left in the mold by the brackets must be filled up even with the parting line, and at the same time a piece of board must be lowered into the cavity made by the wing *C* on the pattern, and held opposite the bracket opening as a backing for the sand while filling up, for it is only the bracket places that are to disappear.

Fig. 4 illustrates a principle very often used, and may represent almost any pattern where we wish to use a plain round stock core at a considerable depth from the parting line *A B*. The "heels," or sometimes called "finger prints," *D D* reach from the desired position of the core to the parting line and make an opening in the mold to admit and sustain the core. A board *E*, called the "stop-off piece," must be used in this case, as in Fig. 3, but here we cut a semi-circular opening in the bottom edge to rest over the core, while filling in the places made by the prints *D D*. If this were not done, the bottom edge of the piece *E* would rest on the top of the round core, and as the piece is placed inside the body of the mold on the line *x y*, covering the space *D*, there would still be an opening around the core for the sand to fall through into the body of the mold.



STOPPING OFF AND SAVING PATTERN WORK.

Fig. 5 is a familiar example of a pipe pattern which is to be stopped off to a shorter length. To do this, simply nail on a temporary flange to each half, as per the dotted lines, and make the stop-off piece shown below at *A*, to place in mold, the part *c* being the same size as the core print on the pattern, and the flange part *d* the diameter of the temporary flange fastened to the body of the pattern. With this piece in position the part of the mold which represents the flange on the end of the pattern is filled in, and also what would otherwise have been a part of the pipe body between it and the new flange. It will be noticed that the same core can be used without any changing for the different lengths of pipe.

Frequently it is desirable to make a leg casting for some special machine shorter than the regular pattern on hand, and at the same time not injure the pattern by cutting it. Much the same principle is involved here as in the pipe example mentioned above. Attach new feet, temporarily at the positions desired, and make a stop-off piece, just the size of one of the new feet, for the molder to place in the mold while filling up the part beyond it, that is not wanted.

Fig. 6 shows how to make a pulley or a wheel of a smaller diameter than the original pattern without injury to it. Turn up a rim of the diameter required, fit it over the spokes as shown by the dotted lines, and saw a curved board, shown in section at *A*, for a stop-off, to place in the mold to fill up the spokes, or arms projecting beyond the new rim, the outside radius of *A* matching that of the new pulley.

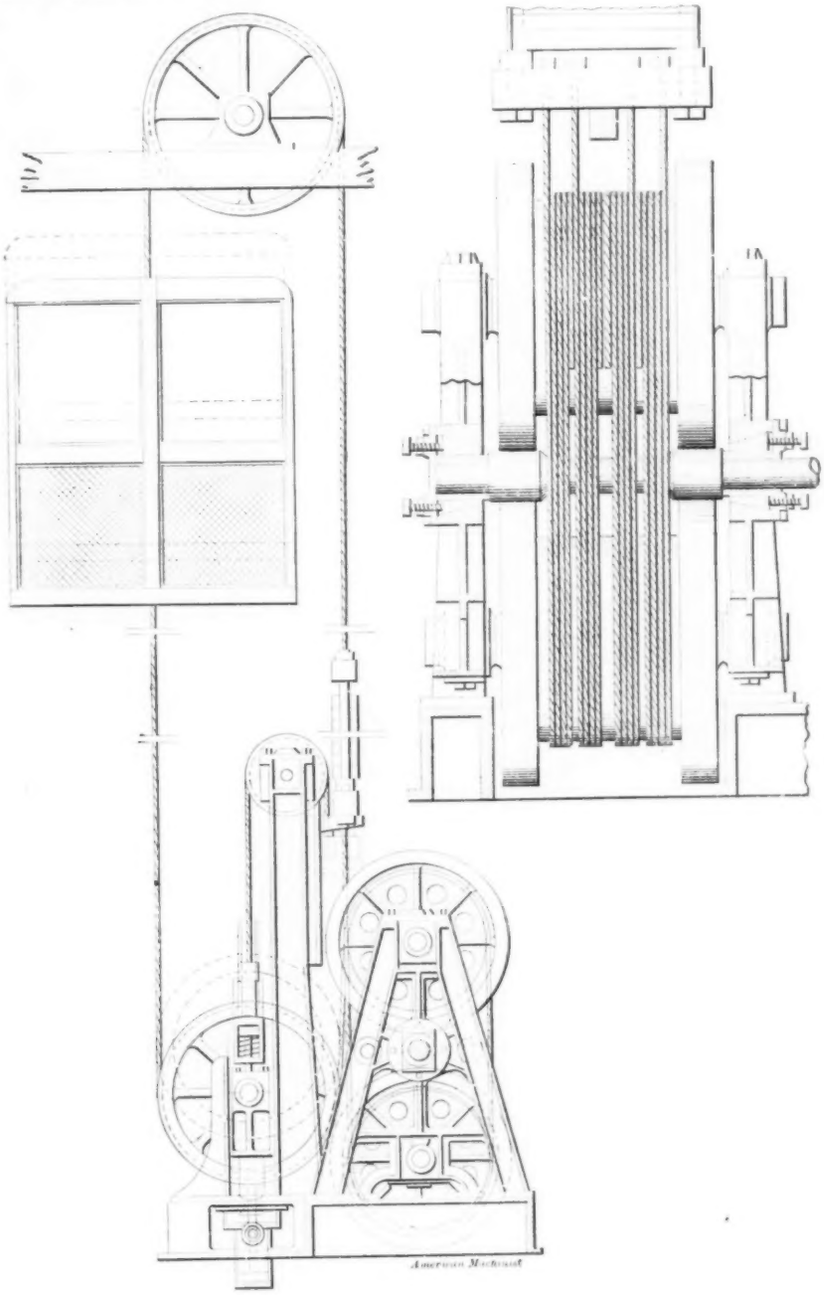
Fig. 7 shows a somewhat different case than either of the preceding. It is a bushing pattern, 18x6 inches, with a straight 4-inch core, and we wish to stop it off to produce the casting shown at *C*, which is 12x6 inches, having a chambered core 4 inches diameter with ends 3 inches diameter. The requirements are, to use the pattern and corebox *A* and *B*, without injury to either. We simply need a piece *D* for the mold and two semicircular shells *E*, one for each end of the corebox, to reduce the diameter to 3 inches.

The left-hand flange on *D* is the diameter of the core print on the pattern, the right-hand one the diameter of the body of the pattern, and the intermediate portion that of the holes in the ends of casting *C*. This piece will have to be placed in the sand four times to fill against—once in each end of each half of the mold. The thickness of the flanges is immaterial, but the diameters and the lengths, 5½ inches, must be preserved.

The left-hand flange of *D* leaves the mold larger than the end of the core, but this makes no difference, as it comes at the extreme ends, and there will still be plenty of support for the ends of the core.

An Improved Elevator.

It is a fact familiar to those who have to do with elevator work that the hydraulic elevator is necessarily very inefficient considered as a machine for conveying energy because the same amount of water must be used in the cylinder regardless of the load lifted, and it therefore requires as much expenditure of power to lift the lightest load (or no load at all) as it does to lift the heaviest load the elevator is capable of handling. Again, the mechanism is essentially the same as a block and tackle used backwards, *i. e.*, to multiply motion instead of force, and this, with the numerous bends of steel cable about the sheaves, wastes power, the net result being an efficiency which in high buildings is said to be as low as about 5 per cent. It is to overcome this objection and to secure other advantages as well that Michael E. Neenan, of 420 West 124th street, New York city, has devised the elevator shown in the accompanying engraving. In an A-frame are the bearings for a shaft to which the motor or other driver is attached and above and below this shaft are drums about which the cables are passed in the manner indicated. The bearings for both these drums are movable vertically and the winding of the cable about them tends therefore to bring them together, and they are prevented from coming together only by the fact that two friction pinions on the driver shaft come between the friction surfaces on the drums and thus the pressure upon the friction wheels increases with the load. It is expected that this friction will be at all times ample for the purpose, but in case it is not or there is thought to be a possibility of slippage spur gears and a pinion with pitch diameters equal to the corresponding friction gear diameters can be applied. The cables lead direct from these drums to the top sheaves and there is interposed here the counterweight for the car, which in the usual system requires a separate cable or cables and sheaves. At the other side the cables pass under a tension sheave as shown, and thence direct up to the bottom of the car so that, as will be noted, there is always precisely the same fixed total length of cable between the top and bottom sheaves on both sides, and thus a constant balance is maintained without the necessity for providing for shifting balance as is usually done, sometimes by attaching one end of a heavy chain to the bottom of the car and to the other end at a fixed point half way up the runway, so that its weight is automatically shifted to or from the car as the latter ascends or descends. Fig. 1 gives a general view of such an elevator and Fig. 2 a view on a larger scale of the cable drums and frame. By this arrangement no more power need be applied than is necessary to lift the load being handled, the frictional losses ought to be enormously reduced, the machinery takes up much less space and is greatly simplified.



AN IMPROVED ELEVATOR.

The Throb Artistic.

"You've heard of people who liked to buy books and magazines with uncut leaves because they took a sort of artistic delight in going through them with a paper cutter, haven't you? It often happens that they never read what is printed inside at all. It is just cutting the leaves and glancing through that gladdens their hearts. Well, sir, I know how they feel. I have the same thrill once a week. When I get the envelope with my pay in it I know there isn't a cent there that I can have for my own use, yet, do you know, I simply can't help opening the envelope and looking in? It must be the artistic feeling that comes to the book lover. I can account for it in no other way. If I didn't care for that thrill I might just give the envelope unopened to my wife, and let her pay the money out. But the privilege of cutting off the end of that envelope and looking in is worth my whole week's work. After all, there's nothing like the artistic throb, is there?"—*Chicago Record Herald.*

"The Need of Technical Training for Southern White Boys" is the title of a pamphlet issued by the Manufacturers' Record Publishing Company, Baltimore, Md. It is the outcome of an address by the editor of the *Record* at the last annual convention of the Cotton Spinners' Association of the South. A practical remedy for the need is proposed.

Mechanical Antiquities — A Box of Engineers' Instruments 200 Years Old.

BY E. P. BUFFET.

One of the greatest benefits from delving into the past is that it teaches contemporary humility. It has been said that the more a man reads of ancient literature the more he is impressed with the modernness thereof. Yet generally in studying old mechanical constructions the constantly excited wonder—as in the case of a dog playing on a fiddle—springs from the fact, not that the performers did their work so well, but that they did it at all. To this there are exceptions which we are perhaps slow to realize because we come for the most part of Northern European races which have but recently emerged from a state of semi-barbaric crudity, whereas the more Southern peoples reached a state of highly cultivated ingenuity at an earlier period. Of that the set of drawing and mathematical instruments now to be described is witness.

The extrinsic history of this remarkable collection is brief. They are the property of Franz. F. Nickel, member of the American Society of Mechanical Engineers, chief draftsman at the Worthington pump works, Brooklyn, N. Y. By his grandfather they were acquired in Germany at a time when they were hardly less antique than they are to-day. But the tools tell their own story of their origin. Many of the separate pieces bear in full or in part the inscription "Dominicus Lusuerg Mutinensis Faciebat Romæ Ao. 1701." (Dominicus Lusuerg, of Mutina,* was making it, at Rome, in the year 1701.)

The outfit comprises an assortment of drawing utensils which in form, completeness and arrangement bears a striking resemblance to the high-grade sets of to-day. Hardly a modern improvement is lacking; hardly a crudity is visible. Thus much for the design. When it comes to comparative workmanship, few of our present-day drawing appliances are better and many are very much inferior. To examine the close-fitting joints, the accurate straight-edges and the otherwise beautiful execution of these priceless instruments is to marvel at the skill and pertinacity of the Italian craftsman, who with tools of imaginable simplicity wrought this elaborate work. In his days the work was doubtless one with the man to an extent little known among us.

It is not indeed true that the accuracy of the fits in these implements as they stand is in all cases on a par with what we exact from our latest precision machinery or that their graduation is as faultless as the work of a dividing engine. But it would be unjust to say that in the places where light may now be seen between the edges of the folded rules it could have been detected when the instruments came from the hand of their maker, two centuries ago.

* Now Modena.

This collection contains not only drafting, but other instruments, for mathematical and special engineering purposes. It has pre-eminently a military air, which is not surprising in view of the date. As the savage sees in any mechanical contrivance that falls into his hands a novel instrument of torture, so the people of old times, despite their occasional proficiency in detail handicraft, seem to have considered manslaughter the most important field for invention. The year 1701, in which Dominicus Lusuerg accomplished his work of art, marks the beginning of the War of the Spanish Succession, when

Malbrouk s'en va t'en guerre,
Mironton! Mironton! Mirontaine!
Ne sais quand reviendra.

Thereafter, over a space of a dozen years the leading nations of Europe were involved in that useless struggle marked by the Battle of Blenheim with its accompanying campaign of fire and pillage, over which, a few years ago, one waxed indignant when reading "Henry Esmond." It is a possible—almost a probable—conjecture that the outfit now before us was used in the engineering work of this famous war. Indeed it is possible that some of the guns at Malplaquet which drove the French out of Italy were sighted with one of these very instruments. But to proceed to a description of the pieces in order:

FIG. 3. REVERSE VIEW OF BEVEL.

THE UPPER TRAY.

The instruments are contained in a leather-covered box with brass handles, and are embedded in two trays, each about 10¾x17 inches, which are illustrated in Figs. 1 and 2. Fig. 1 is the top, or movable tray.

In the upper left-hand corner we see an adjustable brass angle, bevel or protractor. It is graduated along the entire circumference around the pivot, the semi-circumference exposed to view being inscribed "Anguli Interiores," while that hidden by one leg of the instrument when closed is marked "Anguli Exteriores." The purpose of the compass on the pivot is not obvious, since it does not allow of adjustments comparable in nicety with those on the graduated scale encircling it. To furnish a fixed angle of reference in rough drafting it would be of small utility. It may have been intended for use in some sore of plane table field work, although there are no sights on the instrument itself, nor places to attach them. The eccentrically graduated arc about the pivot on the reverse side (Fig. 3), marked *Pro Eleuatione Bombardae* (For the elevation of a cannon), indicates that at least one use of the instrument was in artillery service. There is, in fact, above the arc a pin hole from which a thread carrying a plumb bob may be hung. Something more will appear concerning this in connection with other of the instruments. On the front side of the angle the face is engraved with two rectilinear scales—a *Semipes Geometricus* (Geometrical Half-Foot) and *Semipes Romanus* (Roman Half-Foot). Both are divided into twelfths of a foot, or inches, and an inch on each is subdivided into tenths. According to the Century Dictionary, the Geometrical or Philosophical Foot was in use in the sixteenth and seventeenth centuries by writers of all countries and equaled about 9.8 modern English inches, but this scale by actual measurement is on a basis of about 11½ inches. By the same authority the ancient Roman foot was 11.65 English inches, while by Knight's English Encyclopedia (1868) the modern Roman foot is 11.72 inches. The latter seems the better to agree with the foot on the scale before us. On the back of the instrument (Fig. 3) is a scale of the *Semipalmus Romanus* (Roman Half-Palm), a Roman Palm being, according to authority, about 8½ inches, but by measurement here fully 8¾ inches. This also is divided into twelfths. Finally, on the other leg of the angle, in the same view, is shown a decimal diagonal scale based on the Roman inch.

Immediately below the instrument that has been described is a brass parallel ruler (Fig. 1), which requires no verbal explanation, except to mention that there is a slight lateral concavity in each half, enabling it to lie the more firmly; that one of the outer edges is undercut, and that in spite of its age the pivots are still remarkably free from play.

Next in order is a folding ruler or straight-edge of massive construction, and provided, as are many of the other instruments, with dowel-pins after the manner of its modern wooden antitypes. No standard of length is engraved upon it, but its convenient surface is taken up with several useful scales. The side of the legs appearing in Fig. 1 is marked in dupli-

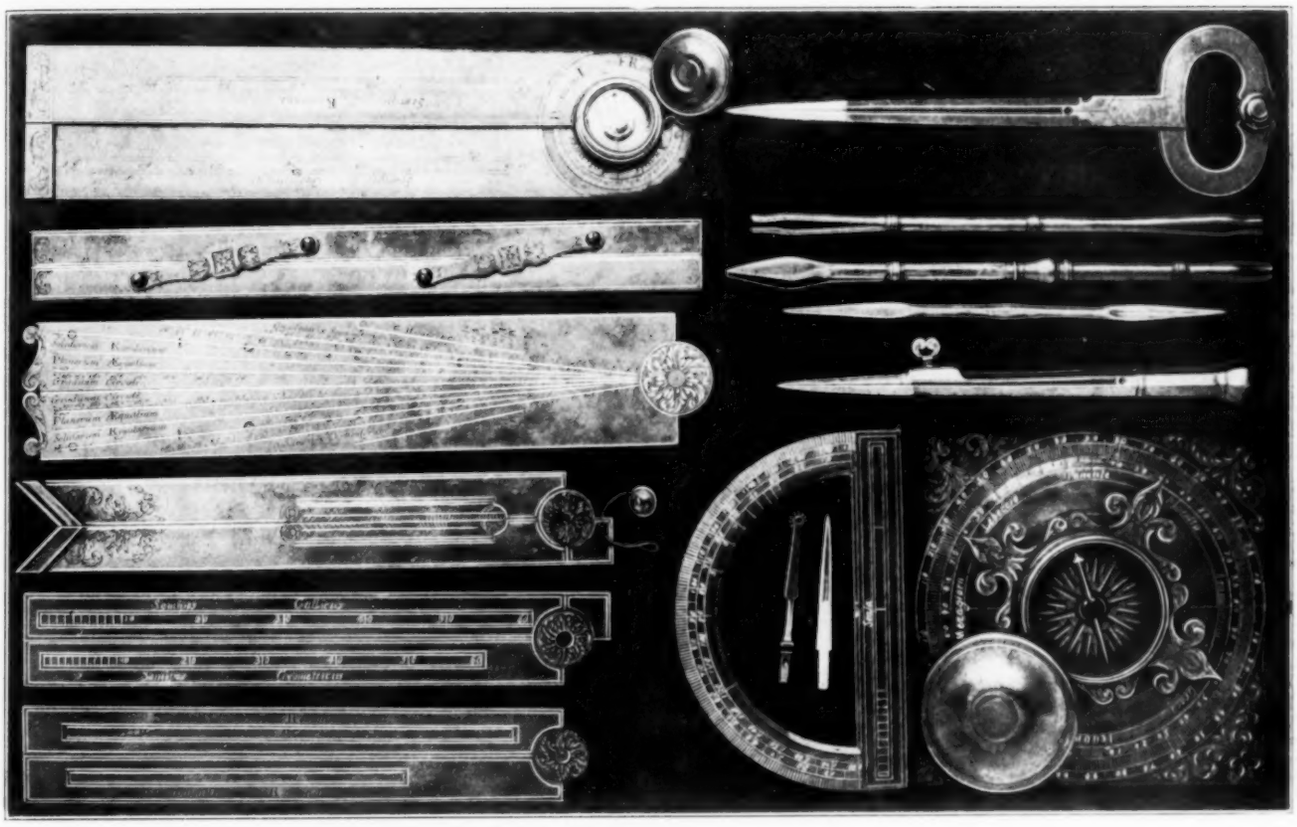


FIG. 1. ENGINEER'S INSTRUMENTS 200 YEARS OLD—THE UPPER TRAY.

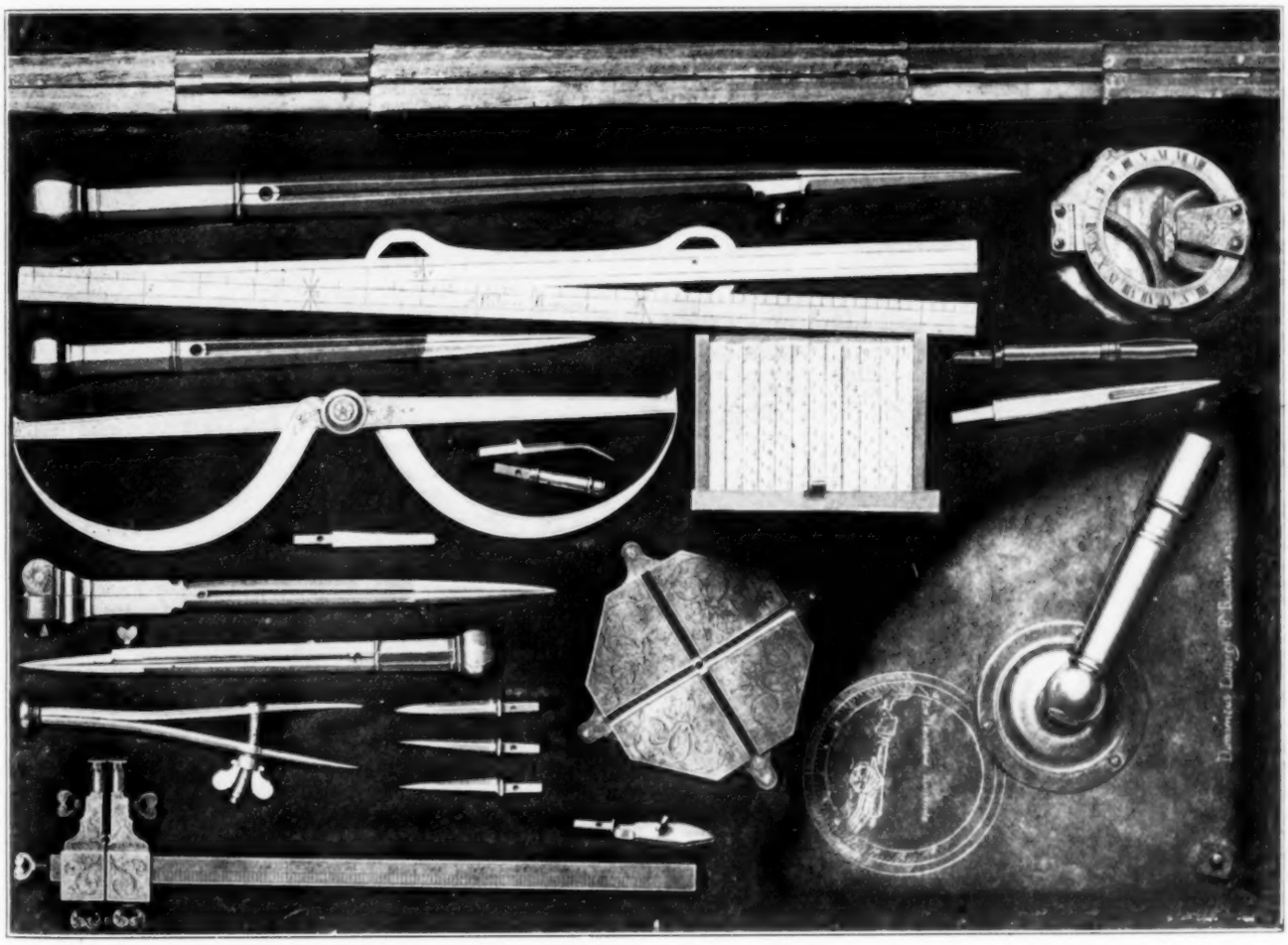


FIG. 2. ENGINEER'S INSTRUMENTS 200 YEARS OLD—THE LOWER TRAY.

cate with the following: A gradation of symbols several of which are recognized as denoting the metals gold, mercury, lead, silver, copper, iron and tin. They are

FIG. 4. REVERSE VIEW OF STRAIGHT-EDGE RULE.

probably intended to be arranged according to their specific gravities and are spaced for this purpose with fair accuracy in relation to each other, though not so in reference to a zero point. We notice also scales designated *Quadratrix Segmentorum* (Square of Segments?), *Solidorum Regularium* (Of regular solids, having to do with the regular polyhedrons); *Planorum Aequalium* (of equal planes), and *Graduum Circuli* (of degrees of the circle). The last mentioned is a scale from 0 to 180 degrees relating, possibly, to the lengths of chords drawn from a point in the circumference of a circle. On the other side of the legs of this rule (Fig. 4) are scales in duplicate, designated as follows: *Figurarum Regularium* (of regular figures), *Planorum* (of planes), *Solidorum* (of Solids), and *Partium Aequalium* (of equal parts).

The next appliance, which is depicted folded in Fig. 1 and open in Fig. 5, is one of the most beautiful pieces of workmanship in the box. The difficulty of the fits is obvious. When opened up it comes into position with spring enough to give it just about the proper degree of firmness after all these years. It might have been used

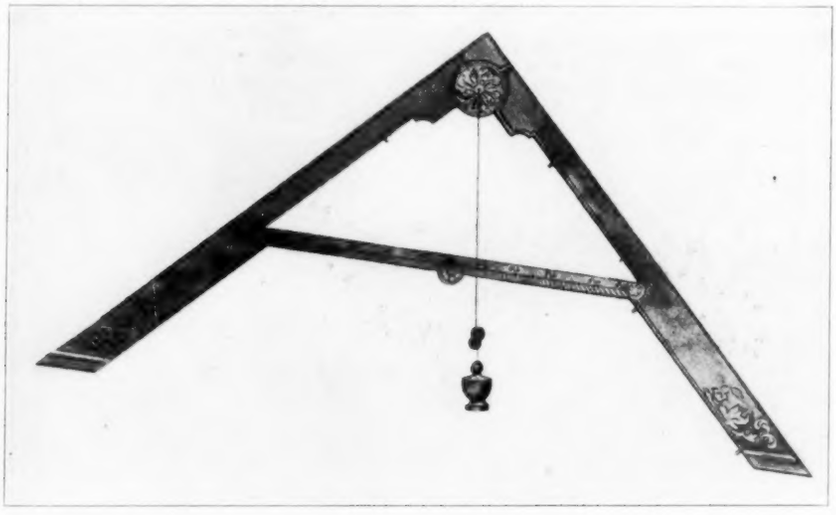


FIG. 5. INCLINOMETER.

as a triangle for the drawing board, but manifestly was designed also for an inclinometer, the plumb bob being attached as shown. In a French book of plates on scientific arts (*Recueil de Planches sur les Sciences, etc., Paris,* 1763) is illustrated an instrument somewhat resembling this one, intended for giving the proper elevation to mortars. In use it was squared against the muzzle.

Next below this (Fig. 1) comes a folding square engraved on the face with a Geometrical Half-Foot and also with a further variety of half-foot—the French (*Gallicus Semipes*). The French foot as determined by the Russian Commission is 12.789 inches, and this closely agrees with the actual measurement.

At the lower edge of the tray is another straight-edge rule, the face of which is inscribed with the Roman Half-Foot and Roman Half-Palm.

Passing to the upper right-hand corner of the tray, we see a pair of fixed point dividers, the points being of steel and inserted in the brass instrument quite after the manner followed to-day. The joint is *quintuple laminated*, if it be allowable so to designate the existence of three folia on one side of the hinge dovetailing with two on the other, as in high-grade modern drafting instruments. The structure of the joint is shown in Fig. 6, the lower portion of the bow being, it may be observed, eliminated in the photograph. What will especially cause remark is to find on this ancient divider the bow-shaped shanks with which both the opening and closing movements are made by pressure directed inward.

Next in order (Fig. 1) is a crayon holder of familiar type. Another of these is combined with a drawing pen having an ample diamond-shaped point adjusted by a compression ring. A drawing pen point made of brass and adjusted by a screw in the present fashion will be noticed in Figs. 2 and 7. Reflection upon how short a time it is since the steel writing pen succeeded the quill—and some people have not laid down the goose feather even yet—adds to the wonder of finding metal drawing pens that were in use two centuries ago.

The double-ended stylus with sharp grooved points (Figs. 1 and 7) is suggestive of the boxwood pens that are now sometimes employed for lettering—specifically in the drafting room of the Brown & Sharpe Manufacturing Company. It may be concluded that the utensil shown was intended for free-hand inking where a writing pen with the customary split point would generally be used to-day.

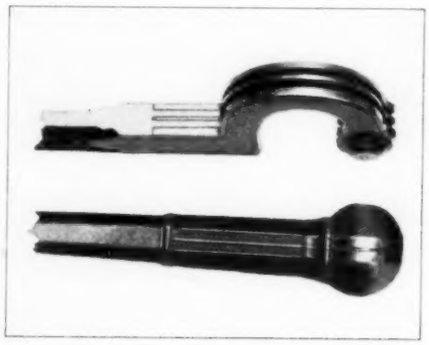


FIG. 6. SHOWING CONSTRUCTION OF DIVIDER JOINTS.

The detachable point dividers (Fig. 1) appear at first blush to have an inexcusably swelled head, but when it comes to twirling them in the fingers little fault will be found with its shape or size. The interchangeable points of the dividers are held in place with a screw as upon the commoner sort used now, except that there is a slight hollow in the shank to receive the point of the screw instead of depending upon its friction. One of the interchangeable members is a grooved ink point (see also Fig. 7) with a smaller channel than those of the free-hand pen, and the other is actually a dotting pen (Fig. 7). The teeth of the minute spur wheel are slightly grooved on either side in a radial direction apparently to promote the even flow of ink. I believe that dotting pens are still considered too much of a novelty to work well.

The semicircular protractor seen in this tray is marked on the circumference with 180 degrees, as usual, while the interior side of the curved rim bears a diminishing graduation which has a peculiar relation to the angle at the point. Starting from the left-hand 0 on the scale of degrees, and apparently from a point not included on the semicircle for the varying scale, we find the following coincidences between the markings of the former and the latter:

60 degrees with 3, 90 degrees with 4, 108 degrees (sensibly) with 5, 120 degrees with 6, 128½ degrees (sensibly) with 7, 135 degrees with 8, 140 degrees with 9, 144 degrees (sensibly) with 10, 150 degrees with 12. I can but conjecture that this varying scale is the expression in round numbers of some rule determined experimentally or otherwise, and from the association with other instruments in the box, that it may have something to do with the range of projectiles. On the diametrical base of the protractor is engraved a scale of 4 inches, which by measurement are shown to be French ones.

Finally, in the lower right-hand corner of the tray rests a magnetic compass. The compass box with the four ornamental pointers attached swivels about on a graduated circle engraved on a square brass plate.

THE LOWER TRAY.

Referring now to the lower, or fixed, bed of the instrument case, Fig. 2, we notice first a pair of dividers, 13½ inches long. The joint, which is of the massive

FIG. 7.

type before noted, is quintuple laminated, to use a former expression. It has a point which may be interchanged with the crayon holder or the ink point lying near the right-hand side of the tray.

Next below the large dividers is a 2-foot

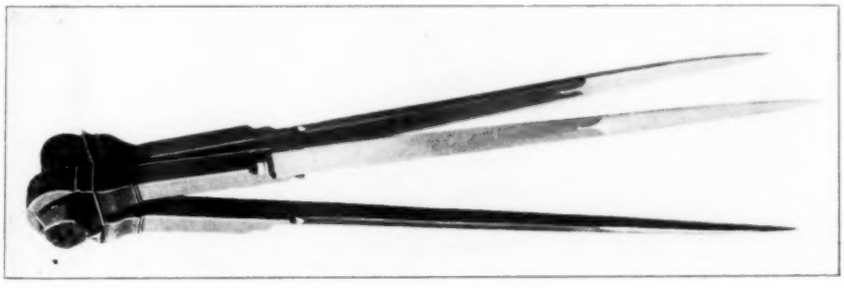


FIG. 8. THREE-LEGGED DIVIDERS.

folding brass rule. The scale on the side exposed to view is based on the Roman Palm, but the unit engraved on the other side is the *Pes Vienne* (Viennese Foot)—12.443 inches—which makes the fourth variety of standard foot found in the case, not to mention the Roman Palm. Embedded behind the folding rule is a double-ended wrench, which probably is intended for some portion of the engineering outfit not contained in the box. Next comes a smaller pair of fixed point dividers, the joint made in the same way as that of the large one, and below them an inside and outside caliper. It is obvious that for use the legs of this caliper are to be swung around to a different position. The nicety with which the points spring into the same plane when reversed, and with which they meet when arranged in either this way or that, is among the many instances of fine workmanship afforded by the case of apparatus.

With all the other conveniences in the box it is hardly surprising to find a three-legged divider (Figs. 2 and 8), which draftsmen to-day regard as a luxury.

A pair of dividers with screw adjustment comes next. Below them is a pair of stiff steel spring or bow dividers with brass head, the curved screw being cut with a thread of half-V form.

One of the later owners of this priceless collection was more of a utilitarian than an antiquarian and he planted a pair of compasses or two somewhere about a school yard. This explains a few empty compartments in the trays and also a few superfluities among the interchangeable points. Such attachments, as shown in the lower tray (Fig. 2), include a protected point, a bent point with a cutting edge, a

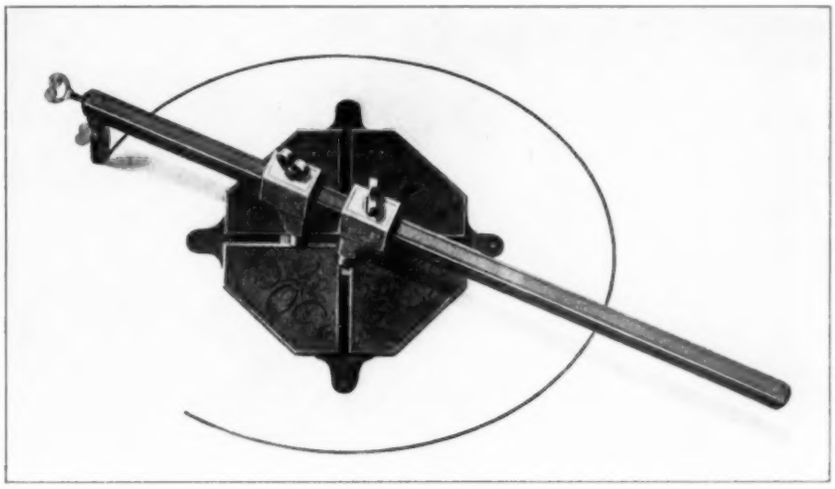


FIG. 9. ELLIPSOGRAPH.

crayon holder resembling a split chuck, three triangular points, and, nearest the bottom of the tray, the brass drawing pen point already referred to. The last two

FIG. 10. SUN DIAL.

are shown also in Fig. 7. Some of these points, especially the pen, are applicable to one of the instruments remaining to be described—the ellipsograph. This is of a type still in vogue. It is beautifully formed and elaborately engraved, which does not prevent it from doing very good work. If it were to be redesigned to-day, however, the uprights would no doubt be considerably shortened, with a consequent gain in ease and accuracy of the motion.

The twelve rectangular prisms in the brass box constitute an abacus or calculating machine, a forerunner of the slide rule. These prisms are made of wood and covered with paper printed for the most part on all sides with Arabic numerals. Their owner, I understand, has fathomed the mysteries of their manipulation. If any reader is desirous of doing likewise he would better take preliminary lessons from his laundryman upon the *shwanpan*.

composed of wooden beads on a frame, with which his bills for collars and cuffs are made out weekly.

In the upper right-hand corner of the

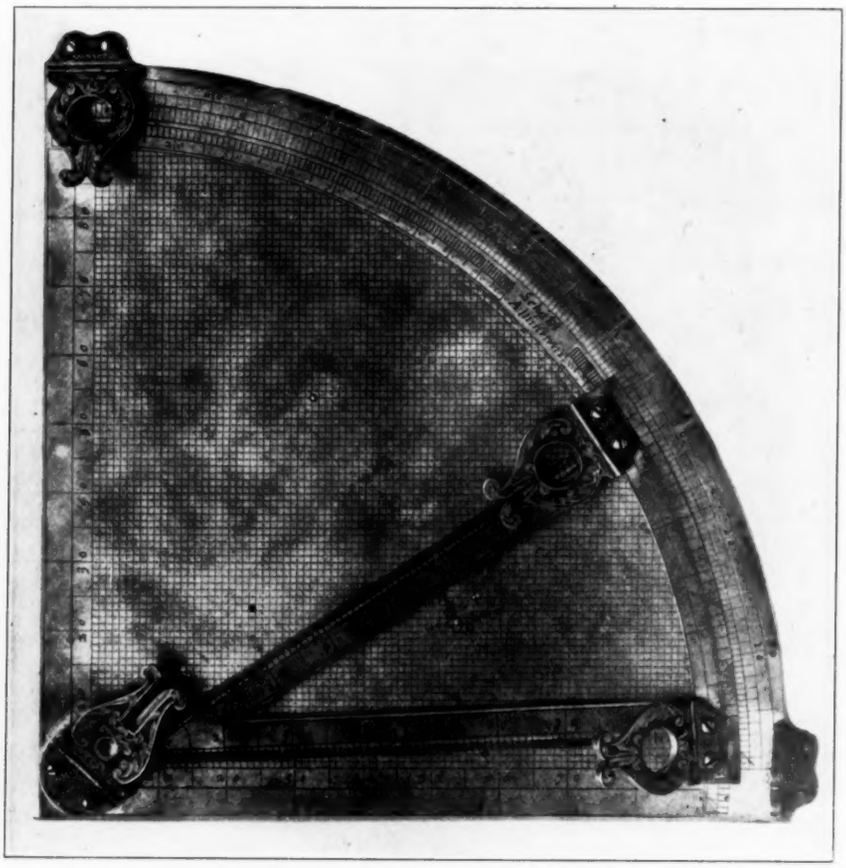


FIG. 11. CURIOUS QUADRANT OR ALTIMETER.

tray and shown separately in Fig. 10 is a sun dial. To determine the hour of day with this timepiece it is placed on a level surface, adjusted for the latitude on the folding graduated arc tangent to the ring-shaped dial and set in the meridian by reference to the attached compass. The gnomon, which for use is sprung to a position at right angles to the plane of the dial, casts a shadow upon the inner side of the ring. For ready reference the base is inscribed with the latitudes of prominent cities of Christendom, but no mention is made of New York nor even of Chicago. To determine the time precisely, a correction for the seasons of the year would be necessary.

AN ALTIMETER.

There remains to mention one other instrument—the large quadrant which is shown inverted in the lower right-hand corner of the box, and a view of the top side of which is given in Fig. 11. It is provided on the bottom with a socket to fit a tripod or post, and a ball and socket joint by which it may be leveled like a plane table, or held in a vertical plane. The surface is engraved with cross-section lines graduated up to 90 in either direction. The arc of the quadrant is divided into 90 degrees. A sector with angle of 30½ degrees is pivoted on the right angle, its arc being divided into thirty parts, so that with the arc of the quadrant it forms a vernier. The sides of the sector are graduated to correspond exactly with the sides of the engraved quadrant, with which they may be swung around to coincide. The arc of the quadrant bears also another scale marked *Schala Altimetra*. It begins at a zero point a few degrees outside of the quadrant, as engraved, though still on the brass plate, and runs to a point marked 100, which corresponds to 41 degrees on the quadrant. It is a diminishing scale, its units near the 100 mark being little more than half what they were at the beginning. This scale is described in duplicate symmetrically from each end of the quadrant arc. At the vertex of the sector is a folding peep or rear sight, having a swiveling movement independently of the angle, while at each other corner of the quadrant and of the sector is a folding globe or front sight fixed in direction toward the rear sight. These globe sights, it is evident, were once provided with cross threads. On the bottom of the plate is an eccentric circular scale resembling the one shown in Fig. 3, similarly marked *Pro Elevatione Bombardae* and provided also with the small hole for the plumb bob thread. There is, moreover, an engraved sketch showing the quadrant held with its edge squared against the muzzle of a cannon for adjusting the elevation. But this is only a secondary use for the instrument and does not explain the meaning of the complicated devices on the top side of the plate. The evidence is pretty strong, however, that it is a range-finder or at least an altimeter for measuring altitudes, to wit, for obtaining the data that are availed of in sighting the gun with the little scale on the back side. The absence of a mirror renders the method of its use hard to explain by analogy to that of the nautical quadrant. It has baffled several engineers who have examined it. With a view to solving the puzzle, I have made some research in ancient works on gunnery, but have not taken time to pursue the subject to its ultimate. A better plan will be perhaps to throw the question open to the readers of the AMERICAN MACHINIST.

Included in the outfit are four detached sights—two front and two rear (Fig. 12). They are intended to be screwed on wherever they may belong, in a different way from those of the altimeter, being provided with threaded shanks, and are somewhat smaller than the others. They are adapted to no instrument in the box and presumably belong to some larger piece of apparatus which formed part of the engineer's outfit.

One noteworthy feature of Lusuerg's set of drafting utensils is, that few of the straight-edges are graduated at the margin. The scales on the rules are engraved on their faces with border lines around and the divisions frequently are emphasized by punch pricks. Nor are the markings prodigal. Signor Lusuerg probably had no dividing engine and was compelled to space off his graduations by a slow primitive method. We notice that he had a variety of standard feet, though from what we may judge of measurements in his day, some of them were not intensely standard after all. In the sixteenth century it was customary for mathematicians to print the scales referred to in their books along with the text; doing this, it

FIG. 12. FOUR DETACHED SIGHTS.

is believed, not merely as a rough illustration, but as an actual standard. The shrinkage of the paper in these volumes has amounted to about 1-42 in length, so

that in determining the lengths of the old feet from the books it is necessary to make a correction. There was a time when the standard foot, it is said, changed with that of the reigning king. That must have made a confusion almost as bad as between our English and metric systems. But as the dissentient weathercocks of New Amsterdam afforded a wind to the mind of every man, so an elastic scale of length gives a foot to suit the buyer and one to suit the seller and others to suit anybody else.

Echoes from the Oil Country.

KNOCKS.

"Them fellows are hollering up there at the mill. I wanted to send a man up to put their old rattle trap together, but they wanted to be too saving, and I guess they don't know enough to do it right. We made them a new head, rod and rings yesterday and they thought that was all they needed. Go up and see what is eating them, anyhow."

As I was addressed, I gathered up a few tools, rolled them up in my "Gladstone" bag—a grain bag ripped open, by the way—slipped my long belt lacing around the combination and swinging it over my shoulder started up the street, whistling and—thinking of what I was to do, do you think I was about to add? Now, I just wasn't.

Let me let you into a very valuable secret, one that only came to me after considerable experience.

When I first began to go out on jobs I used to run over in my mind everything I could think could possibly be the trouble, and a few things that couldn't possibly be. When I got to the place, if the job was at all like I expected, I often lost valuable time looking for what I had expected to find, and mostly I didn't find it. Just as often I found the machine and conditions entirely different from my thoughts, and so it was labor lost.

I used to have a feeling that as I was employed by someone else I owed him all my time, and if I enjoyed myself out on a job it was not working; but a little more experience showed me that it was results the company wanted, and that they didn't care whether I worked hard or took it easy, but they did care most emphatically whether I made the other thing work or not. After a bit I saw that when I struck a job with my mind blank, as far as it was concerned, I could take in just what I found and reason from effects to cause much better than if I had to crowd out a lot of notions to get room in my mind to think of it as I found it. After that I tried to keep from thinking of the job, and would whistle or sing (I called it singing), look at the birds, admire the scenery, or any other thing that came handy while I was on the way, and I found it lots easier to see what there was and to listen to the man in charge and get his facts. It was better for the company and I had lots of enjoyment out of it; even out of some of the unpleasant things, for if one has to go without a meal he generally gets an appetite large enough to make up for it.

When I reached the mill I found the engine pounding "in great shape," and not being one of those gifted fellows who can lay his hand on a knock the first try (did you ever notice that those fellows, if they work in the shop, are always kept there and not sent out? They are often philanthropists who work for small wages and give their advice free so as to keep the boss from losing his job and the sheriff from getting the firm), I started in to hunt it.

Your real knock hunters, the ones that *can* handle them, know what that sometimes means. The good mechanic that has never been up against it has not received his thirty-third degree yet. The larger the audience, and the more ignorant of mechanical matters the owner, the more variety can be gotten from it. In this case they wanted it taken out without stopping if possible, and if not the stop must be as short as it could be made.

The engineer, who was also fireman, had looked things over and was stuck. I first tried the quarter boxes on the main shaft and thought it helped a little, a very little. The engineer had tried it; they got warm, had to let them out.

Stopped and keyed up the rod on both ends; no good, and it got warm. Took off the cylinder head and could find nothing. Examined the disk on the crank and hit the key a lick: all tight. Tried the key on the flywheel: also tight. Disconnected cross-head end of rod and tested for crank being in line: found it O. K. The manager of the mill was hopping around in the way, storming because I stopped things and the engineer refusing to run with that thing knocking. Men gathered around, making remarks about machinists in general and one in particular. I didn't like to try to clean out the crowd, as I thought most of them would suit the boss, who wanted a man with a "weak mind and a strong body"—at least in the latter part of it—so I sat down to think, and I finally concluded that the piston head must be loose enough to move with the load on. I disliked to think that, as it was rather a reflection on the shop, but couldn't see anything else to blame it on, and I took off the cylinder head again and squirted a little oil on the end of the rod where it was riveted, and thought it looked a little loose when I hit it. I then tried riveting up the best I could and put on the cylinder head and started, and everything was lovely for a few minutes; then it began softly at first and finally became so violent I shut down and took out the piston head and told them to send it to the shop, as it was too large for me to carry.

The foreman did not want to believe that the head could be loose; I didn't either, for that matter, and when it got there he was ready to prove to me that it wasn't. It was cool enough to handle then, and was loose enough to turn on the rod, yet I was told that the rod had been driven into that head with a sledge when the head was red hot, the head and rod both put on the fire until the end of the rod was red hot and then the end riveted.

While I rather doubted it at that time I am ready to believe it now, and don't know of a poorer way to do. It might be one way to reduce the diameter of the end of the rod, but it could be done quicker and cheaper by turning it down before riveting it in. Press forging is hardly machinists' work.

I once repaired an old engine that had the piston head *shrunk* on. The man who did it was evidently in a hurry, as he forgot to do any riveting, and it had been run for years that way and had been all right and I couldn't move it with a sledge.

The one I had trouble with was different. The man who had bored the head had counterbored on one end to get a larger shoulder, and this prevented me from seeing what a movement there was when I got it out. In trying it in the engine I had to stop with the valve covering the port on the open end, as the throttle leaked enough to keep a man away otherwise: there was more than enough hot water dropping down at the best. This I suppose kept the head out against the rivet.

The new head was shrunk on with a very modest allowance for shrink and a low heat, and I did my best to be allowed to rivet the rod cold, but I had to give way on that point. That head stayed on until the mill burned down, and the knock was gone when the engine was going again.

I think the man with a sure cure for knocks has a fortune in his grasp if he can make it work the first trial. My faith in my own cure has decreased in proportion as my experience has increased. Very often I have done things to stop a knock when I did find it, that it would be hard to give a clear reason for doing, unless it was that I couldn't think of anything else to do. On one occasion I had a very annoying knock that was finally located in the pillow blocks. The engine was a 10x12-inch, center draft, that ran a saw mill and was new, having been made by the company I was working for. It would run very nicely except when pulling the saw through the log. The sawyer would take a run at the log, throwing the governor valve wide open with the "sawyer's" lever, and the engine would speed up. When the log was struck the knock would begin, and as soon as the saw was through the cut it would quit.

With the block swaying back and forth, and all the parts giving a little, it was not easy to either see or feel which place seemed the worse, and noises seemed to come from all directions. I did not have a free hand either, as the foreman was with me and directed me. Finally, after

trying everything else, I was told to knock the babbitt out of the caps and re-babbitt them. The boxes were rather peculiar, being made in three parts that divided the circumference into thirds, one part forming the bottom bearing and the other two parts acting as quarter boxes and making the rest of the bearing, a plate holding them down. A wooden liner went between them on top (that is, between the two quarter boxes) and also between them and the bottom part. The back parts of the quarter boxes were tapering where they fitted the bed and pushed in to take up the side slack whenever they were drawn down. They fitted the bed on the back on three chipping strips and were a good fit.

After I had babbitted them the engine knocked as badly as ever, and I tried wedging in tin between them and the bed and thought it helped a little, but when two or three boards were sawed the knock was as bad as ever. This led the foreman to believe that the babbitting had not been a good job and he directed me to re-babbitt.

As I had babbitted and seen others babbitt a good many of them, and knew this one was as good as any of them, I hated to do it, more particularly as it was nearly supper time and I was hungry; besides I did not believe it would help it any.

You see, I thought the foreman was blaming it on me simply because he didn't know what else to blame it on—just like the man who said his dog was a coon dog because he had tried him at everything else and found him no good.

The foreman and owner were in another part of the mill for a few minutes, while I poured the boxes, and started up only to find the knock still there, and I was looking for a way out before they came back. Slipping the top plate off on each side, I drove nails between the bed and the quarter boxes, getting what slack I could by it, which was very little. I then poured the spaces between the chipping strips full and knocked the nails out and put the plates back on just as the foreman came walking back and said we had better go to supper. I requested one more trial first as it might save us a trip back.

Everything ran nicely; no knock with the heaviest load. "I knew if you got a good job on that babbitting things would be all right." This was aimed at me. "Didn't I tell you so?" That was aimed at the owner.

"I wish they would run two or three of the largest logs so as to be sure it is going to stay before we leave it," said I. We have been fooled several times today." This was done, and as the minutes went by with things running rightly the foreman proceeded to kindly but firmly impress on my mind the necessity of doing things right the first time, thus saving both time and the reputation of the shop.

When he had done a good job at it, I told him what I had done to stop the noise and offered to remove the extra babbitt to demonstrate whether that was the real cause of the noise stopping. This he declined to have done, preferring to let well enough alone, and so we left it without loss of more time, and didn't need to make a night job of it, although supper was a little late. W OSBORNE.

A Successful Rotary Engine.

It is often claimed in American engineering papers that no rotary engine has proved to be of practical value. This is a rather surprising statement, as we have in Sweden a rotary engine, constructed by the Hult Brothers Rotary Steam Engine Company, Stockholm, which not only has been very successful, but is beyond doubt the most popular engine in Sweden. I herewith send you a description from *Engineering*, which will give you an idea of the general arrangement, though many improvements have been made lately in the construction. The Hult engine has many marked advantages over the ordinary steam engine. The number of rotations is from 500 to 1,500, and for a 30 horse-power engine it is 750 per minute. The space required for this size is 50x25x20 inches, and the steam consumption 39 pounds per brake horse-power per hour without condensation and 29 pounds with condensation. From this it will seem that it compares favorably with the best high-speed engines, and it has come into extensive use for all purposes, when high speed and small size are of importance, as, for instance, in directly driving dynamos, centrifugal pumps, etc. So it has been accepted in the Swedish as well as in the Russian navy for lighting purposes. A promising feature about the Hult engine is the manufacturing cost, which is less than one-third of that for an ordinary steam engine of the same size, and judging from this and other facts it is likely to have a very great future. As yet the Hult engine is not introduced in America, but will appear at the Exposition in St. Louis in 1903. The photograph, Fig. 1, shows a Hult rotary engine connected direct to a fan. K.

[We append drawings and abstract a description from *Engineering*, London: The engine in the drawings is a double one and reversible. The two cylinders *R* and *S* receive steam alternately, so that there is no dead point and the turning effort is fairly constant. There is a great reduction of friction in this engine, in the fact that the cylinder turns as well as the piston within it. The piston is a roller and the cylinder likewise is free to roll. The piston must make contact with the cylinder at two points and the second must have a sliding contact, but as the cylinder and the piston are both moving in the same direction at nearly the same velocity, the work lost in friction is not great. There are two roller bearings on each end of the engine, one for the piston and one for the cylinder. Figs. 2 and 3 are sections, at right angles, of a twin engine. The steam enters at the right hand of Fig. 2 and passes to the central tube in which there are ports. Fig. 3. It then passes through the passage 2 and exerts a pressure on the shutter protruding from the piston. The upper straight passage has just opened to the steam while the lower passage 2, which relates to the second engine, has been closed for some time and the steam is now expanding in that engine. The two curved passages are the exhaust, which escapes around the rotating cylinder. The cylinders and the pistons run on different centers and the point of contact is always at the top. This forms one closed joint and the shutter the other, the expansion of the steam taking place between them. The rotating pistons each run at one end against the end of its cylinder, and at the other end against an adjustable plate, the two plates being forced

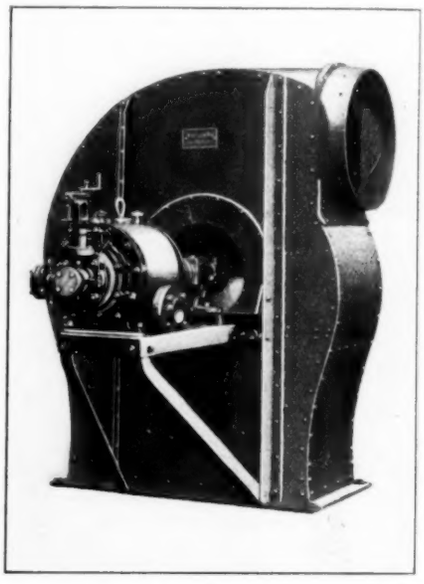


FIG. 1. HULT ROTARY ENGINE DIRECT CONNECTED TO A FAN BLOWER.

apart to take up wear by pressing wedge-shaped pieces between them by means of the screws shown. Fig. 3, it will be noticed, gives a broken section, the right-hand half showing one engine and the left-hand half the other. The points of cut-off may be changed by rotating the inner tube by aid of the handle shown to the right of Fig. 2. This has the effect of causing the port to be closed earlier or later by the rotating central piece 1. It is by this latter piece the stoppage and reversal of the engine is effected, this operation being performed by the reversing lever shown. When this lever is in the mid position the tubular piece 1 will shut off the steam channel 2, so that no steam enters the cylinder, and the engine is stopped. If the lever be moved to the other end of the segment, the piece 1 will be further turned, so that the channel 2 becomes the outlet for the steam, and the

channel 3, which previously was the outlet, becomes the inlet. In this manner the engine is reversed. The connection between the reversing lever and the tube 1 is not very clearly shown in the engraving, but it will be seen that there is a link at the bottom of the machine, with a lever passing through the frame at the left-hand end, and operating a rod passing through the central shaft.

There are five sets of roller bearings in the engine, two for the rotating pistons, two for the cylinder, and one at the end where the power is taken off. The piston bearings, Fig. 6, have each a movable roller path, which can be centered by means of screws to bring the pistons into the proper position to bear upon the cylinder. These bearings are on the outsides of the frame, Fig. 2. The cylinder bearings, Fig. 5, have each eleven rollers, and are inside the frame. The remaining set of rollers forms both a bearing and a transmission gear, for reducing the speed of rotation. The five rollers run on pins, Fig. 2, projecting from a disk or face-plate, Fig. 3, at the end of the shaft to be driven, each roller having a set of rollers in its eye to reduce wear and friction. The rollers are sprung into place between the central shaft and an external fixed roller path. As the shaft turns it rotates the rollers, which carry the face-plate with them since they are in good frictional contact at each side. The result is that the speed of the outer shaft is reduced, in relation to the engine shaft, in proportion to

$$\frac{d}{D}$$
$$1 + \frac{d}{D}$$

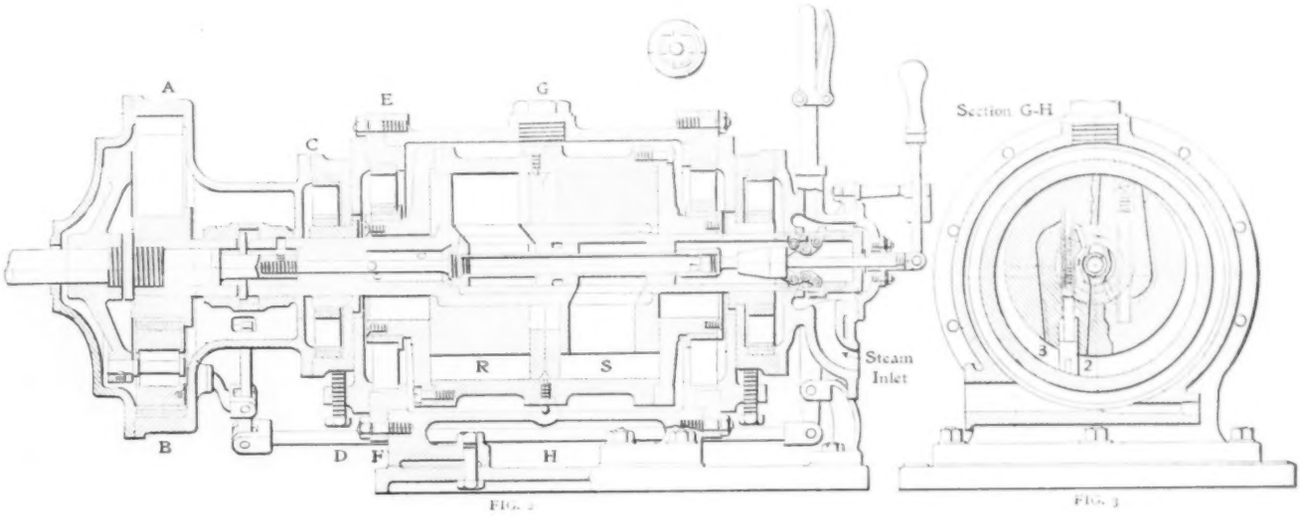


FIG. 2 FIG. 3

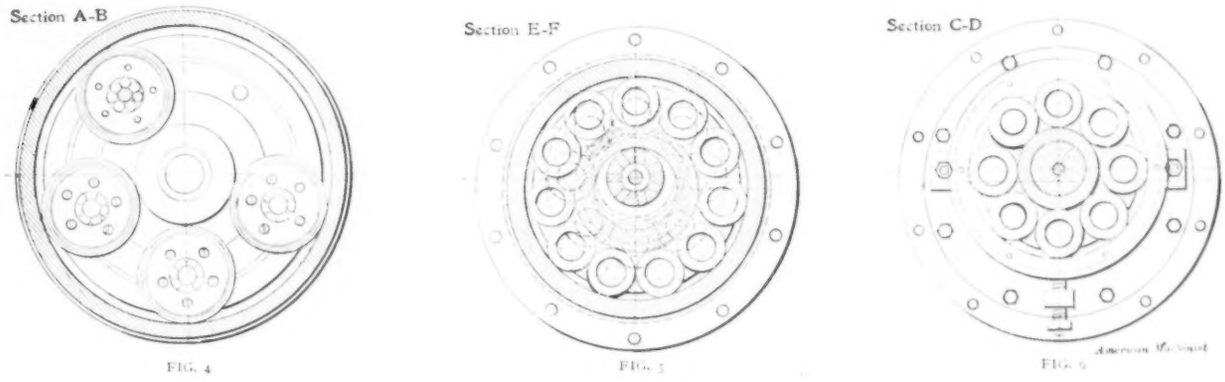


FIG. 4 FIG. 5 FIG. 6

DETAILS OF HULT ROTARY ENGINE.

Manuscript and Drawings for Publication.

The following extract from a recent letter will doubtless interest certain of our readers:

"As I told you when I first wrote you only a few months ago, and as you probably caught on to without my telling, I have had no previous experience in writing for any publication. As you have done me the honor of printing all the pieces that I have sent you I am of course much pleased and more or less surprised. I am also somewhat encouraged now to assume that if I send you some more some of it at least will be acceptable. I venture therefore to ask you whether what I have sent you has come to you in the best kind of shape, and, if not, what are my faults or deficiencies and how can I do better in the future?"

It is not necessary to indicate to our readers the writer of the above, nor to reproduce here the precise words of our reply to him, but his case suggests to us that it may be a good time for us to offer a few words of information and suggestion to our correspondents in general, as a considerable interval of time has elapsed since we previously did anything in this direction.

It is to be supposed that those who prepare any matter with a thought that it may be suitable and acceptable for our columns do not want their labor for their pains, and as we are happy to say that we are constantly receiving more contributions than we can possibly find space for, and of course accept and use what is most acceptable and usable, it is to the interest of all to come to us in as correct and acceptable shape as possible.

Of course, the most necessary thing of all for a writer is for him to have something worth writing about. The AMERICAN MACHINIST is first of all a newspaper. It aims above all things to give the latest news about the actual doing of work and about the ways in which it is done, especially the new things done and the new ways in which they are done. It is not necessary to insist so much on the cheap and economical ways of doing things, because they are included so completely in the fact of novelty. New things are not going to be done unless it is desirable and profitable to do them, and things are

not going to be done in new ways unless those new ways are, in some respects at least, better or more advantageous than the old ways.

If, then, anyone has something new and valuable to tell us we want it no matter what shape it comes in. Within reasonable limits we naturally expect our writers to do somewhere near as well as they can in preparing their matter. We have to confess to an occasional spasm of disgust when some roughly scribbled and crudely sketched and generally tangled up affair comes to us with the evidence all over it that the sender could have done his work much more correctly and precisely if he had only thought it worth while, the implication being that the editor has plenty of time, skill, patience and all the other requisites to put it in perfect condition. When it is remembered that the matter that appears in our columns is only a comparatively small portion of all the matter we handle, and that each letter or article has the most minute and careful revision and correction, in some cases extending to the almost entire re-writing and re-drawing, some idea may be had of our leisure and of our appreciation of *unnecessary* work when it is put upon us.

The above remarks are only for the very few to whom they apply. Our contributors generally not only try to do well, but they actually do so, and they, we know, will welcome a few hints that may enable them to do better or that may correct some individual points of omission or of commission.

What is written is to be read, and it should therefore be first of all legible. Most people can write plainly if they try to, and it is well worth while to try. Typewritten matter is of course the ideal now, but legibility is all that need be desired. The writing, as everyone knows now, should be on only one side of the paper, on sheets of any reasonable size, and not fastened together in any way, but correctly numbered at the top of each page. Never put any sketch or drawing of any kind on the same page with the writing, but always on separate paper. Never write any longer than is necessary to say just what is to be said, and when it is said stop. Don't use long words when short ones are better and clearer. Write as nearly like correct talk as possible. If you want to say a thing was "made," don't generally say it was "constructed." If you would say that a shaft "turns," don't generally say that it "revolves." It really rotates instead of revolves, but saying that it turns leads to no mistakes. If the attempt is fairly made to just write talk, the best reading results. In mailing the written matter never roll it, but just fold it, and if a large envelope is used so that the folds required will be all one way, so much the better.

As to the drawings it does not make the slightest difference what size they are. They should always be made large enough to be clear in every detail that is meant to appear. Good drawings are of course appreciated, but hand sketches are acceptable, especially for small and uncomplicated views of separate pieces. Sketches should usually be inked. Faint pencil lines cause lots of trouble and dissatisfaction. It should never be attempted to make anything the same size that it is to appear in our columns, but usually much larger for the sake of distinctness. Drawings or sketches if not large may usually be folded and mailed in a large envelope, while large drawings should be rolled and enclosed in a stiff pasteboard shell. Drawings on stiff paper or tracings are neither of them nearly as acceptable or convenient as blueprints. It is usually an inconvenience to return either manuscripts or drawings, but it is our usual practice to do so when unavailable; but when the return is imperatively required it should be so stated.

The writer's full name and full address should *always* be written on every manuscript and drawing or photograph sent to us. There is no exception to this. It should literally always be done. If such name or address is not to be printed, a line drawn around it will prevent its being printed, or if a *nom de plume* is to be used and is written in, that only will be printed.

As to photographs, almost any kind will do, so long as they are not a bad kind. That is, they should be clear and distinct, the larger the better, and preferably ordinary albumen prints. They need not be mounted.

Do not write descriptions or explanations of drawings or photographs upon them, but make the necessary description or explanation a part of the article, using reference letters when necessary.

We have, after all, enumerated here only a few simple particulars that can easily be complied with, so that it is not a difficult thing to prepare and send us matter in very acceptable shape and condition, and it is with us always sure of the welcome it may deserve.

Beer as a Life Saver—A Low Pressure Boiler Used for High Pressure.

Our esteemed contributor, Mr. Reinhold Betterman, sends us the following from the *Johnstown* (Pa.) *Tribune:*

To the Editor of the Johnstown Tribune:

Sir—Since the story has leaked out about that explosion at South Fork and my narrow escape therefrom, I would like to narrate my experience, and give due credit to a glass of beer, to those who are too hasty in signing remonstrances.

We had steam up in a small vertical boiler of apparently sound condition, but it would not draw, so I suggested a blower, which I knew from my own experience would help the thing along better—not intending, however, to blow it up.

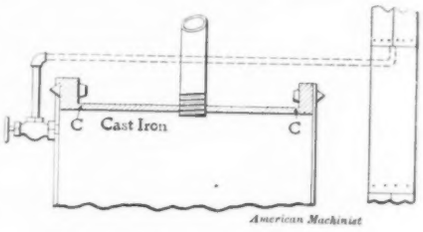
To put on the blower I had to go and purchase a piece of pipe, and, on returning with the same, it came to my mind while passing the Baker Hotel that it was a long time between drinks. I thought a glass of beer would not hurt; so I got one and soon proceeded to the boiler. When within a short distance of it I heard a loud report, and pieces of pipe and fixtures went flying straight up into the air, the boiler shell remaining on the foundation—then all was over.

Now, if I hadn't indulged in an innocent glass of beer I would have been right on top of the boiler to participate in the heavenward journey with the rest of the stuff; and then, good-bye.

It did scare me for a moment, but I could not help laughing at one of the fellows standing near the boiler warming himself (I believe it was Bert), who exclaimed: "D——n the shooting!" The Italians were blasting rocks in the vicinity, and my companion took it for such a shot without the usual warning, until the pipes came falling down to solve the mystery as to the cause of the racket.

REINHOLD BETTERMAN.

Mr. Betterman sends us a sketch of the top of the boiler, with some additional in-



TOP OF THE BOILER THAT EXPLODED.

formation. The boiler was made for low pressure steam heating, and had a low pressure gage with it when it was bought at second hand. The purchaser put a high pressure gage on and arranged to carry the pressure up to 100 pounds. The flat cast-iron head was only ⅜ inch thick, without stays or braces, and of course it gave out, shearing all around clean at *C*. Mr. Betterman, who of course knew nothing about the construction or the unsafety of the boiler, was proposing to put in a steam jet or "blower," as indicated by the dotted lines.

One of the latest inventions described in a Chicago newspaper is a windmill which is placed on the front end of a locomotive boiler, and by its rotation drives a motor which electrically lights the train. This may be a great thing, but we have an idea that a small engine of some type, possibly a steam turbine, driving a dynamo, will be found much more reliable and satisfactory.

If I were driving a dirt wagon I would read up on the peculiarities of a mule. I would want to know how a shovel was made and the best shape to make it to handle dirt.—*Wood Worker.*

Letters From Practical Men.

The Eye and Its Care.

Editor American Machinist:

There was no need for excuse or apology for the insertion of Mr. Ridderhoff's admirable article on the eye, which should interest all mechanics. Noting that he observes that he has failed to find marketed a spectacle frame admitting of easy changing of mica, celluloid or other lights, I

SPECTACLE FRAMES WITH REMOVABLE LENSES.

would suggest that such should be easily made, if none are already made, by slitting the upper half of bows to the extent of a little more than the minor diameter of sights, which may then be inserted and fixed in place in a moment or two, held firmly without liability to displacement.

I. W. PAYLER.

Grinding Hacksaws.

Editor American Machinist:

I have been worrying for many days over the letter signed "A. Sufferer," page 489, about grinding hacksaws, and I wish he would enlighten me as to how he grinds them. Does he grind the tops of the teeth or the side, or does he get a special wheel with a sharp corner that will go between the teeth? L. O. DANSE.

Editor American Machinist:

I am told that the readers of the AMERICAN MACHINIST can't grind the hacksaws. I don't know of anyone who has been able to do the thing yet but myself, yet it is simple. I take no pains, but just walk over to *any* emery wheel; am less than one minute at it, and the result is that a saw which will not cut at all before I touch it on the emery wheel will then cut off brass, iron or steel an inch in diameter, or iron pipe that has a scale on it that a new saw will not cut very long.

Understand! a blue hacksaw cannot be sharpened—only the hard Griffin saws, and grinding the saws is a knack well worth trying to attain. I still reiterate that I have ground saws from three to nineteen times, and shall always do so whatever shop I am in, as they cut a longer time than a new saw. I can find those who have used the saws after I have ground them—one man in particular who laughed at me, but tried the saw himself and saw that it was all right. A. SUFFERER.

[We have seen a sample of the saws as ground by our correspondent, and in conversation he favors us with a little additional information. He goes to *any* emery wheel, with such corners as it may happen to have, the rest being set as close to the wheel as possible. Then the blade is laid flat upon the rest and jabbed against the wheel, touching it at successive spots until the entire length of the saw has been ground. The result is not a likely looking instrument for any purpose. Say that a new saw resembles the top of a picket fence, then the edge of the ground saw would be like the cross-section of a plowed field. We are assured, however, and believe that the saw will "cut."—Ed.]

Jig for Drilling Ball Handles.

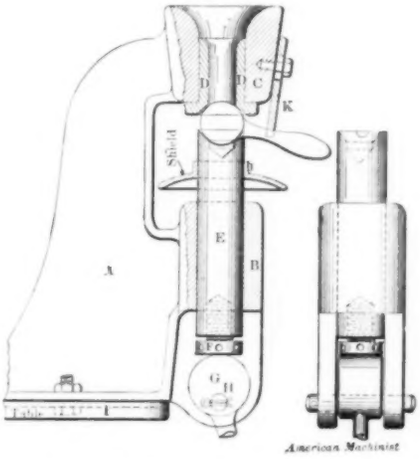
Editor American Machinist:

At page 20, L. E. W. described a jig for drilling and tapping ball handles. The sketch herewith shows another jig for the same kind of work. This jig was first used for drilling 1 3-16 inch holes in drop forgings 2½ inches long; after the forging job was completed the jig was made over to drill handles as in sketch.

A B C is a cast-iron frame; the size and strength of frame is made to suit requirements. *D* is a steel bushing for the drill, and *E* is a piece of cold rolled shaft made a sliding fit in *B*. The steel screw *F*, with holes drilled in head to receive pin wrench, is made a snug fit, or can be made with lock nut to make more positive. *G* is a cam lever for lifting shaft *E*, and *K* is a gage to give the correct angle to ball handle. *I* is the drill press table to which the jig is bolted.

In designing jigs little attention is given to the top of jig for conveying soap water or lubricant to the drill. When space will permit I always cast bell mouth at top, as shown in sketch. This takes the place of, and does the business better than putty.

Experience has taught me, when designing jigs, to do so with a view of protecting all sliding parts from lubricant as much as possible. I remember an incident where a jig of this kind was used for drilling 1 15-16 inch holes. The operator, a young man, like the majority of men of this class, would work the jig, even if obliged to use a sledge. Well, one day post *E* stuck fast, and I found it necessary to take the jig to a vise and remove the post with a heavy hammer. The trouble was caused by fine particles of drill cuttings (so fine they could not be seen with the naked eye) which had washed down with the soap water and worked between *E* and *B*. To prevent this I now use a shield made of cast iron and fastened to post *E* as shown in the sketch.



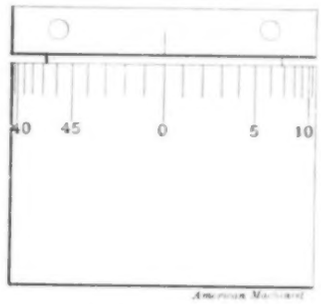
JIG FOR DRILLING BALL HANDLES.

I have used this design of jig for a variety of work by removing bush *D* and shaft *E*. I always keep on hand a number of lever castings of different diameters. They don't cost much and are very handy for jig work. B. M.

Micrometrically Adjustable Milling Machine Collar.

Editor American Machinist:

I read Mac's article, at page 31, "Making Pawls" on the milling machine, with great interest. I wish to say a word about arbor collars. I think Mac a little astray



ADJUSTABLE COLLAR FOR MILLING MACHINE ARBORS.

when he says the best way to make gang saws cut to length accurately is to use paper washers between the collars. In my experience I have found paper washers too slow, and also unreliable as an adjustment. If oil is used the paper becomes saturated, and then they slip. I use instead an adjustable collar, graduated to thousandths. The sketch will explain itself. When I set up gang saws or straddle milling jobs, I adjust the cutter about .005 inch wide, mill one piece, measure with micrometer, note the reading, loosen the arbor nut and adjust by means of the graduated collar as many thousandths as required, tighten the arbor nut and go ahead. This method is not new to all and is a time saver. I am sure friend Mac will find it superior to paper if he will give it a fair trial. If properly proportioned and of good tool steel, the collar will give no trouble.

Buffalo, N. Y. C. W. COBURN.

An Eye Forming Punch and Die.

Editor American Machinist:

On page 857, Vol. 24, I gave a description of a punch and die for twisting the ends of narrow strips of sheet metal. Following this operation, one end of the twisted piece was formed or rolled in a circle forming an eye 7-16 inch outside diameter

by the tools here shown. The device on the punch for completing the job in one operation is frequently used in press shops by expert die-makers, but the method of holding down the long, straight stem when the other end of it is being pressed down into the die, and the means provided for freeing this end and preventing it from being disturbed when the punch ascends, is what interests me and gives me a desire to publish it for the benefit of others.

Fig. 1 shows the die and gage combined for locating the work. The die was first planed all over with stock enough left for a complete 7-16 inch hole at *A*. It was strapped on the face-plate of the lathe and this hole was indicated, drilled and reamed, and then one half of the hole was planed off at *B* and 1-32 inch more at *C*. It was also worked down at one end for the stop-pin *D* and on the other to give clearance for the shaper tool when machining the gage-way and for the twist in the stock. Without disturbing the die in the shaper the vise was swung around at right angles and the groove *E* was planed 5-64 inch for a gage for the work sideways. The rounding of the corner, as shown by the dotted line at *F*, was done at the bench by filing and polishing very smooth with emery cloth. This round corner was to permit the stem of the work to slide freely from beneath the pin *G* on the upward movement of the press ram after the other end had been formed around the mandrel to be described later as a part of the punch. The die was planed on the sides to the shape shown in the end view for clearance for the yoke on the punch. Holes were drilled for stop-pin *D*, swivel screw *G* and pin *H*. After hardening, the edge *B* was drawn slightly to avoid breaking, and rounded with the oil-stone a trifle to prevent the cutting or raising of a burr on the work when forming. The screw *G* supports the horizontal rod that swings in over the stock and holds the stem in a fixed position and keeps it from being bent up on the initial descent of the punch. The pin *H* acts in connection with this swivel gage to stop the movement at the proper position over the work.

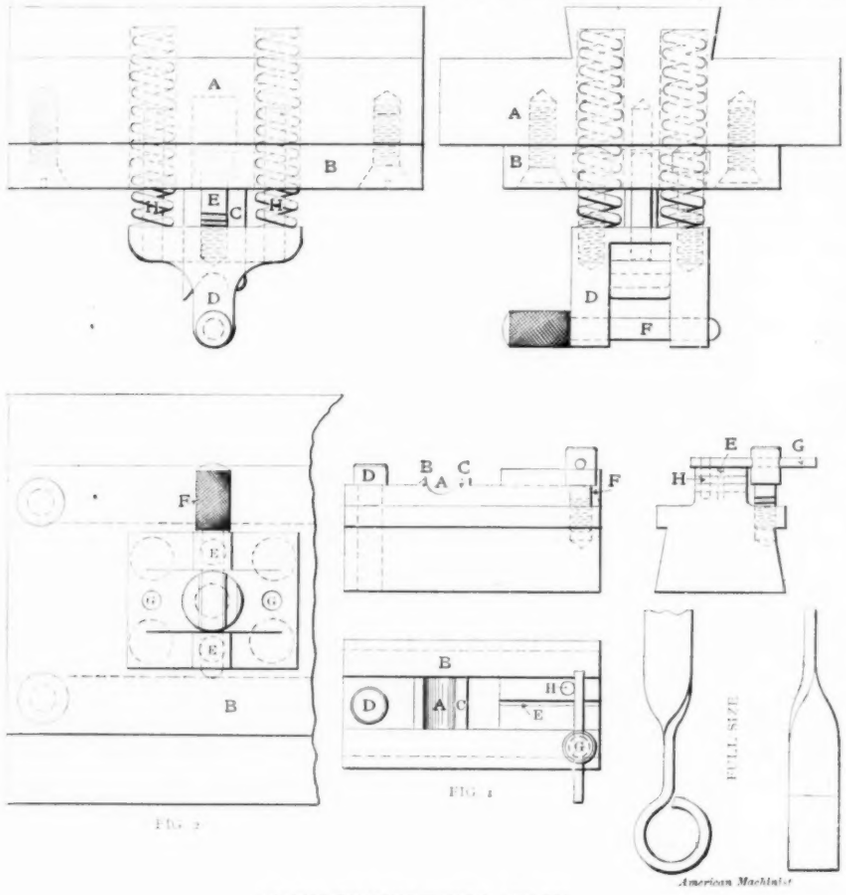
Fig. 2 shows the punch. *A* is the cast-iron holder. Fastened to this by four flat-head screws is the punch plate *B*, into which in turn is driven and riveted the round forming punch *C*, having its lower end shaped to correspond with the face of the die, so that when they come together a 7-16 inch circle is completed. The working part of this punch must be nicely finished and hardened, for when in operation the end of the stock follows along the circle and any tool marks would have a tendency to impede its progress and produce imperfect and unsatisfactory work.

Made from a solid block of tool steel to the general shape shown in the drawings, and with a 7/8-inch hole in its center fitting on the punch *C*, is the yoke *D*, extending downward 9-16 inch, its further progress in this direction being checked by the two filister head screws *E*. On the lower end of the yoke is drilled transversely to the die a 5-16 inch hole to receive the forming mandrel *F*. To retain the alinement of yoke *D* and prevent any twisting motion, two 5-16 inch holes are drilled and guide pins *G G* are driven into its upper surface and made a running fit in *A* and *B*. To hold *D* extended apparently rigid, to force the work down into the die before any perceptible giving away takes place, four coil springs made from 1/8-inch wire are used, two of them being shown in the drawing at *H H*.

To operate the tools place the work in the die at *E*, locating one end against stop *D*, and swing over the outer end of the horizontal pin *G* to hold it down. On the descent of the punch, the work is pressed down in the die at *A* by the mandrel *F* without any appreciable compression of the springs backing up the yoke *D*, Fig. 2.

The end that was against the stop pin *D* being now in an almost vertical position, on a continued downward movement of the press this end comes in contact with the lowest point of punch *C* and is formed around mandrel *F*, which then has to be partly withdrawn to remove the finished work after the elevation of the press ram. In the making of this punch and die, to get good results, the springs behind the yoke must always hold it extended to the limit until the work is shaped in the die sufficiently to bring up the end, in order to enable the punch to catch this end and continue the forming of it around the mandrel. When the mandrel has been correctly alined and the stop properly and exactly located an eye will be formed at each stroke of the press uniform both as to size and general outline. A tool of this design can be operated in a slow or a high-speed press with practically the same results as to the quality of the work.

C. H. Rowe.



AN EYE FORMING PUNCH AND DIE.

Adjustable Limit Gages.

Editor American Machinist:

In reply to the criticisms of S. B. McQuade at page 344, I admit that it is necessary to set the gages correctly, but it is hardly likely that anyone would buy such tools unless he himself, or a foreman, or a toolroom man, were capable of doing it, and doing it consistently. Setting is quite a simple matter, requiring only a little care. If carelessness is to reign supreme in a shop, why have any gages at all?

As for liability to be altered by an unprincipled workman, almost any gage can be altered—a squeeze or a blow is all that is wanted. If a man wants to cheat, he will find means to do it somehow. The gages are so firmly locked that the setting can be altered only intentionally. I do not consider that any form of setting would absolutely prevent fraud, therefore the simpler the means of setting the better.

Our own practice is to check over the first two or three pieces of a lot with a micrometer. That establishes that the gages are right then. If altered afterwards, the responsibility is clearly brought home to the workman. But I am glad to believe that the bulk of mechanics are honest.

As against this possibility of alteration, consider the certain advantages: A reduction in first cost of anything from one-third downwards; a practically ever-new gage.

Mr. McQuade forgot to say that solid gages are always wearing, and that by blind belief in their unchanging truth many costly errors have been made.

Practically the reduced cost and ready adaptability to a variety of sizes takes those caliper limit gages out of the class of tools available for special work only, and puts them into the class of tools available for general work.

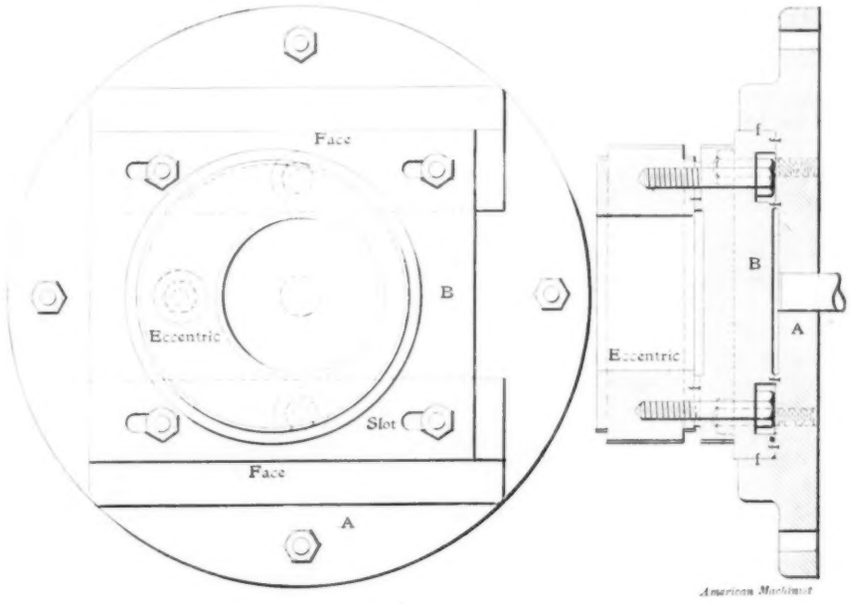
I do not put them forward as ideally perfect, but I do maintain that they are a practical tool "good enough" for regular shop use. JNO. M. NEWALL.

London, Eng.

Turning Eccentrics.

Editor American Machinist:

At page 1359 T. A. B. describes a very good way of making eccentric arbors, which calls to mind the way we did *not* make them in the Pushfinger shops. Our eccentrics were large ones, and we had no end of trouble with the arbors. Our device held the eccentric not only for turning but for boring and facing as well, all at the same setting.

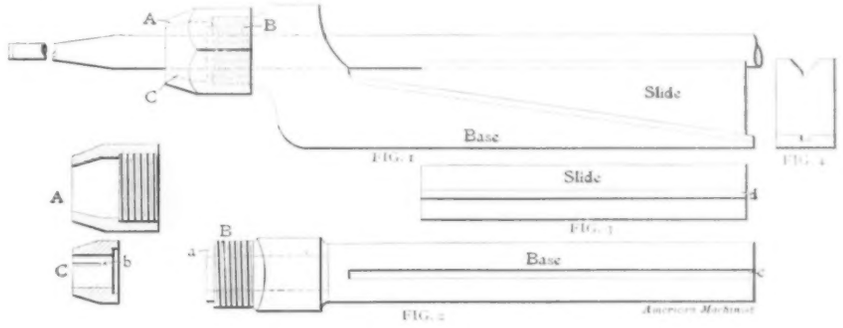


LATHE ATTACHMENT FOR TURNING ECCENTRICS.

A plate *A* is bolted to the lathe faceplate, and accurately centered by a plug fitting the taper center hole. The regular lathe center might be used, or the plate could be cast with a hub and threaded to fit the spindle. On the outer face of the plate are planed a pair of ways, into which plate *B* fits nicely, being held in place by four studs. Slots are provided in *B* for shifting it and the eccentric from the boring to the turning position. The eccentric is held by three tap bolts which pass through plate *B*, which is provided with a pocket on the back for a socket wrench. We made several *B* plates, to accommodate various kinds and sizes of eccentrics and all fitted to the one *A* plate. In fact, if a great many of one kind of eccentric are to be made, it pays to have two *B* plates just alike, so that the plate can be fastened to an eccentric while a cut is running, for the plate *B* has to be removed each time an eccentric is put on.

The practice is to face off the back of the eccentric in lathe, shaper or any available tool, and then use the *B* plate as a jig to drill and tap the eccentric. This applies to the solid style of eccentric, but when the skeleton pattern was used we had taper blocks cast on the face of *B* to fit openings in the eccentric and held there by straps and bolts. As these eccentrics did not require facing, except on the edges, we could remove one and put on another without removing the *B* plate from the machine. We had a few marks on graduations on the plates to insure setting over correctly for the throw. The fixture as here shown requires the removal of four nuts every time the plate is removed; we afterwards arranged swinging clamps that were more quickly operated.

Bavington, Pa. ISAAC MORGAN.



A TOOL HOLDER FOR SMALL WORK.

A Tool Holder for Small Work.

Editor American Machinist:

Having read Mr. M. W. Leech's article at page 352, regarding tool holders, and having used such as are described by him, I send you a sketch of one which I use and find very satisfactory—more so in fact than any I have heretofore used. This holder, the tools for which are made of drill rod (all of the same diameter), may be used in either bench lathes or the larger lathes.

Fig. 1, which is a side view of this tool and holder, plainly demonstrates the utility and simplicity of the same. *A* is the nut which, when screwed on to *B* (the threaded end of the base) draws the bushing *C* against the shoulder *a* and causes it to close around the shank of the tool, thus holding it firmly in place. The bushing *C* is a spring bushing sawed or milled in three places, as shown at *b*. Fig. 2 is a top view of the base of the holder, and shows the groove *c* in which the tongue *d* of the slide rests. Fig. 3 is a view of the bottom of the slide showing the tongue *d*. These two parts shown in Figs. 2 and 3 are milled on an angle of about 5 degrees, thus allowing the slide to move easily.

Fig. 4 is an end view of the slide and base, showing the tongue *d* and the groove *c*. The top of the slide has a V-shaped groove to hold the tool central. While I have but one bushing to accommodate my set of tools for this holder, there may be several bushings made to accommodate tools of various sizes.

HENRY BOETTCHER.

Drilling a Hole Half in One Piece and Half in Another.

Editor American Machinist:

Having had a good deal of trouble in drilling holes which are half in one piece of metal and half in another, as in a cast iron core box, I have found a way out of the difficulty which may be worth

spreading among the other readers of the AMERICAN MACHINIST.

I put both pieces to be drilled in a shaper and with a sharp-pointed tool just mark the work along the center line the drill is to follow.

When the two pieces are put together a very small hole is formed with exactly half its diameter in each side.

Then by using a small drill first and following with a larger one in the usual manner, a perfectly correct hole is obtained, as the small drill follows the marks made in the shaper without trouble.

Antrim, N. H. A. N. NAY.

[Though this trick has been known to some, at least, for a long time, there are probably many others who never heard of it. The corner of a file will answer in place of the shaper when the latter is not available.—Ed.]

The Hand Lathe as a Screw Machine.

Editor American Machinist:

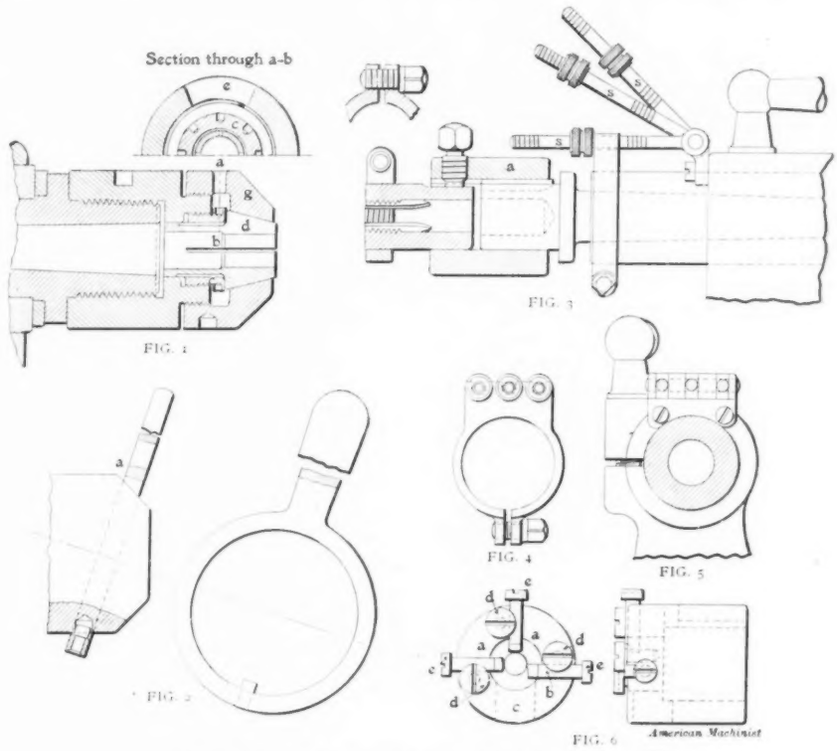
In many small shops, and, in fact, some of the larger ones, the nature or volume of whose product does not warrant a screw machine as a part of its regular equipment, it is often required to make small screws of special shapes and sizes which cannot be found among the stock of the supply man. These are generally made on the engine lathe, which necessarily makes them rather expensive. The accompanying sketches show a device, which, attached to the hand lathe, or, better still, to a small engine lathe, converts it into a very creditable makeshift for a screw machine, and with which not only special screws but many small machine parts may be turned out quite rapidly.

Fig. 1 shows the arrangement for chucking the stock. The hood *g* closes the spring collet *d* by pressing it against the adjusting nut *c*. The section taken at *a b* shows the method of adjustment for stock of different sizes. Fig. 2 shows a very efficient wrench for operating the chuck. It is obvious that when the wrench has passed the point *a* it is an impossibility for the pin to slip from the hole, which is such an aggravating feature of the ordinary spanner wrench.

Fig. 3 shows the method of mounting the tools on the tailstock spindle. The sleeve *a*, which is driven by the key fast in the shank, is bored in front to receive hollow mills or spring dies, and fits loose enough on the shank to allow the dies to lead correctly. One of these sleeves may also be fitted for carrying button dies for the smaller sizes. The sketch shows a spring die, with adjusting collar in position for work. The stops *S*, other views of which are shown at Figs. 4 and 5, do not require any explanation beyond the sketches. It is well to have a number of sleeves, so that in making a piece with several shoulders, hollow mills of different diameters may be mounted and a stop set for each, thus necessitating simply shipping the sleeve of the shank and replacing it with one carrying a different sized mill or die. Fig. 6 shows a very simple box tool. The back rests, as well as the tool *b*, are controlled by the adjusting screws *e*, and the clamp screws *d*. The back rest jaws are relieved at *a*, to allow the tool to lead them on to the work. The hole *c* allows the chips and oil to drop away from the tool.

This tool is easily made, and in the long run is more economical than the hollow mills. By mounting a forming tool on the carriage, if an engine lathe is used, quite a variety of work may be turned out to good advantage with this equipment.

Cleveland, O. E. E. WINSHIP.



SCREW MACHINE ATTACHMENTS FOR A HAND LATHE.

A Broken Crank.

Editor American Machinist:

Your "letters from practical men" are getting more interesting, and I believe it is because we get in better touch with each other by our "heart to heart talks."

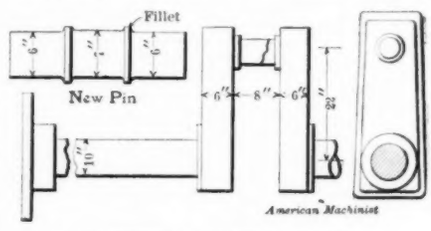
A while ago I helped, in a Southern city, on a repair job, a sure hurry job. The crank pin in a center crank ammonia compressing engine broke one Friday afternoon in August, and as the city's supply of ice was furnished mostly by the plant, it was quite necessary to get it going as soon as possible. The sketch will show how the job was done and suggest some of the troubles one might have in doing it in a shop where modern tools were scarce and where the men were unaccustomed to heavy work.

The old crank shaft was a single forging, nearly alike on both ends, with a coupling flange on each end. We planed off all of both pieces of the broken pin, just truing the inner faces of the crank webs, and the two parts were securely bolted together and a 2½-inch hole was first drilled as a starter for boring the pin holes.

After the cranks had been bored to the proper size, bands made of 2½x5-inch stock were shrunk on. The two parts of the crank shaft and the pin were then taken to a railway shop that had a wheel press and pressed on to the pin, both sides being pressed on at the same time.

The crank shaft was then replaced in the engine frame, coupled up, and, for aught I know, is as good as new—probably better, as the main bearings do not heat as before the breakdown.

We had some difficulty in finding a piece of steel large enough for the pin. A piece was procured (by express) from Cincinnati. No lathe in the shop would swing the crank with what blocks we had, so temporary ones had to be made to help out. The bands not being of exactly the same size, the shrinking on the cranks made the holes for the pin different sizes, one of the holes being drawn about 1-32



REPAIRING A BROKEN CRANK.

scant out of round and the other full 1-32 inch.

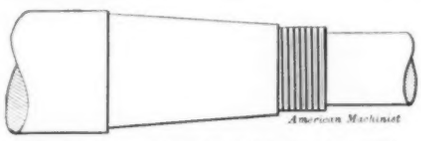
It took about 45 tons for one side of the pin and 53 tons pressure for the other.

AHORA.

A Taper Gage Wanted.

Editor American Machinist:

That taper gage shown by Mr. Sargent on page 202 has been troubling me more than a little. As it stands, it is a simple,



WHERE IS A GAGE OR CALIPER FOR THIS TAPER?

neat and handy tool, but it is still altogether unsatisfactory as a taper gage. It is to me rather the suggester of a problem than a solution of it. There are at least two important particulars in which it fails to satisfy the demands of the case. It is said to be used for lathe centers and such things as that, and for such things it is not impossible to use it; but, in gaging the taper of a lathe center, is the center just laid on the bottom plate, or is it placed so that the axis of it is parallel with the bottom? This would of course make, both theoretically and practically, a difference in the indication of the gage. With one side of the cone frustum laid upon the horizontal plane, and with the vertical planes of the instrument also touching it accurately, if the smaller end of the cone frustum was then raised so that the cone axis became parallel with the horizontal plane upon which it had been resting, either the smaller end of the cone would appear to be too large in diameter or the larger end of the cone would appear to be too small. The difference would of course not be great, but it is enough to talk about and enough to plan to avoid in doing accurate work. If the gage is to be used, as it undoubtedly should be, with the axis of the taper piece parallel with the bottom plate, what provision is there for placing it accurately in this position or for informing the workman when it is there?

Another inconvenience or impossibility that would be encountered in the use of the gage for measuring the usual run of tapers in the shop is in the constant and unchangeable length of the jaws of the instrument. While there would be no trouble if the taper to be gaged was longer than the jaws, there would be serious trouble if the jaws were too long. Say that the taper in the sketch was 5 inches long and the length of the jaws was 8 inches, would it not be impossible to use the gage in this case?

The objections to the gage here spoken of carry suggestions as to the essential features of a satisfactory taper gage or caliper, and I can't say that I have ever heard of one in which they were embodied; so it would seem that here is an interesting little practical problem for shop inventors. I am not saying that there is any money in it, for probably there is not; but still there is considerable satisfaction in trying to work out such a thing, as those who have been into it do not need to be told.

In gaging or measuring a taper it is desirable of course to include as long a portion as possible, and, as the lengths must vary greatly, the first essential must be a variable length in the instrument. This throws out at once the idea of two straight edges applied to the two sides of the taper, as the straight-edges, if long enough for the longest cases, would be too long and entirely useless for shorter work. The only way seems to be to have calipers for each end of the taper and to have the distances between those two pairs of calipers adjustable. This would seem to call for their sliding upon some kind of a bar or frame. In opening or closing the calipers to adjust them to the required dimensions, the opposite legs of each pair would have to move equally and simultaneously in opposite directions, so that the normal axis of the instrument would in use always be in the same plane with the axis of the work. It is of course quite possible to satisfy these conditions, although I do not know where it has yet been done, and when done it may not be any too simple; but there is still another point to be remembered: The duplex calipers here suggested could never be relied upon for accurate work without some means of locating them upon the work in the direction at right angles to the axis and to the diameters to be measured. When using a single pair of calipers, they are passed back and forth over the work and the fingers of the operator readily detect the contact of the points at the line of full diameter, but when measuring with two pairs of calipers at once, it is essential that both shall be in the correct measuring position at the same time, and some means must be provided for securing this. With each pair of calipers there must therefore be a third leg at right angles to the other two, equidistant from them and at the same distance from the work center, or there may possibly be some equivalent device to take the place and do the work of this third leg. In the ideal taper gage all three points when being adjusted should move in or out together. It might be permissible to adjust the central point independently of the others.

It is thus no simple thing to make an adjustable and generally adaptable taper gage or caliper. In addition to securing the essential points of the taper gage or caliper as here indicated, there can come after it various refinements that would add to its value. The adjustments of the points might be made by micrometer screws, so that the instrument could be adjusted without the aid of rule or scale outside of itself. As I remarked before, there is no money in it, but it is an interesting problem that will pay for itself, money or no money. It is far more interesting and profitable than the general problems that are devised from time to time as exercises pure and simple for the inventive faculty without actual relation to any practical usefulness.

MORRIS FULTON.

Grinding the Lips of Flat Drills.

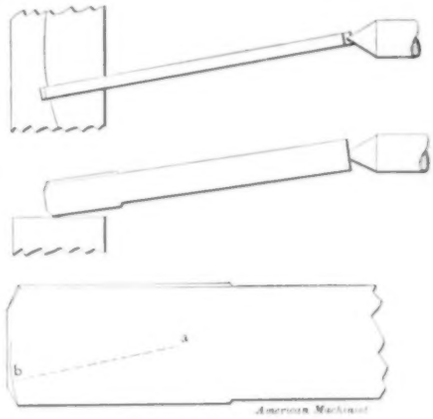
Editor American Machinist:

At page 195 Mr. J. Cook tells of the use of flat drills in English shops and says, in part: "The cutting edge . . . which is in advance will run away from the side of the hole . . . and requires grinding back. . . After one or two trials the drill will cut to size exactly."

A short while ago I worked in a shop where they used flat drills for all lathe work, and while there I was taught a trick in flat drill grinding which I think Mr. Cook, and probably some other of your readers, might be pleased to know. It is this: After forging your drill, having centered it and ground or filed your cutting end to size, grind your cutting lips, then place the center of the drill on your lathe center and with one of the sharp corners sweep an arc of a circle on your cross-slide or on any piece of flat stock laid across your lathe carriage, the back center being then the center of the circular arc (see sketch). When both lips come to the same line the drill will cut to size. Try it, Mr. Cook.

TELBIN.

[The device described by our correspondent is one of an unlimited number for gaging the lips of a flat drill. The lower figure in the sketch is substantially as



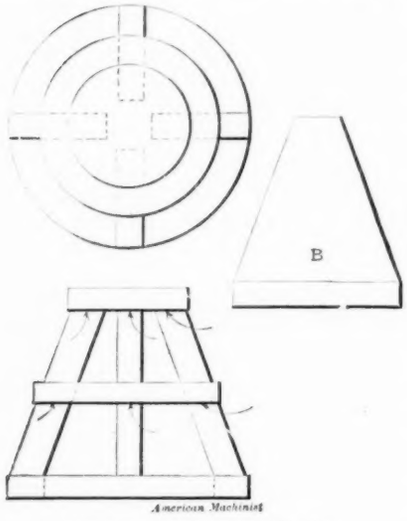
GRINDING THE LIPS OF FLAT DRILLS.

shown in our columns nineteen years ago by Peter Shellenback. A point *a* is located exactly on both of the flat sides of the drill, and from this, with a radius *a b*, an arc is struck with the dividers on each side, and the lips when ground to these lines have the same relative position.—Ed.]

Molding a Spark Arrester—Cone Pulleys—Loam Cores.

Editor American Machinist:

I send a sketch of a spark-arrester such as was formerly used on locomotives. It will serve as an illustration in the molder's art. The casting consists of a conical



MOLDING A SPARK ARRESTER.

open frame, with several steps, although I have shown only three. At first sight it looks as if it would bother the molder to get it out of the sand, but, to use a slang phrase, it is "dead easy." The pattern parts at that part in each step indicated by the arrows. *B* is a block that fits the inside of the pattern and is first laid on the follow-board, and the different parts of the pattern are placed in position over it. The nowel is then laid on and rammed up, packing the sand well in against the block. After rolling over, the block is withdrawn and the cope is rammed up. Provision is made to lift the inside with the cope, then the separate parts of the pattern are taken from the mold. The gate is made, the mold is closed, and it is ready to pour.

Such is the method adopted by our foundrymen as I remember it, although it is nearly twenty years since I saw even the pattern. Since making this sketch I notice that the taper of the pattern must be such that the outside diameter of one step will be at least no larger than the inside of the next larger one to allow a free draft.

I was interested in Mr. John M. Richardson's "Cone Pulley Pattern," Vol. 25, page 322, and I like the idea of the round disk on the two legs. Before I came to that part of the article which describes its use, I thought that surely there must be core prints under each arm, but after the reading it was a simple case of O I C.

I also read "Hobo's" comments on my rope sheave molding, with pleasure, in the same issue, page 344; also his method of making a corebox for the same to suit a molder's ideas. If we can please the molder we are all right, but those that I come in contact with would kick if I made it that way. They always want, if possible, a flat surface to come in contact with the stove plate, and as my standing orders are to make patterns to suit the molders, that settles it. I think that often we could save money in the pattern shop if those in the foundry would be willing to sprinkle a little parting sand on the face of a core and level up with common sand loosely filled in; it would prevent any part of the core from slumping, but might take a little longer to dry.

There is one thing that I think is to be regretted with regard to cores for columns and long cylinders. I refer here to the neglect of the method of building up loam cores on a perforated pipe arbor, covering it with several layers of straw bands underneath the loam. The loam used to be put on in different layers, drying one before the other was put on, and when the last layer was dry it allowed the stock to be turned off to the shape required by holding a "form" against it while the boy rotated the core as it rested on the horses. Such cores invariably helped to produce good castings, but my experience in this country is that the molders will not think of it, and prefer a green sand core where possible. There is always a free escape for the gas from these loam cores, and if ignited as soon as it begins to escape it gives no trouble. WM. NEWTON.

Hinge Making in an Old Shop.

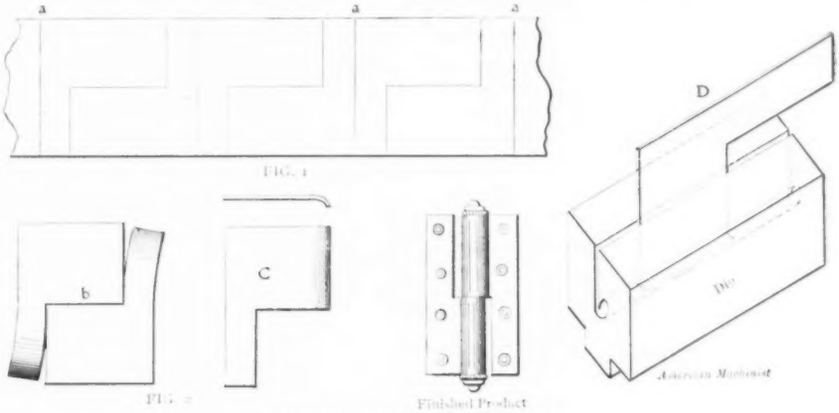
Editor American Machinist:

Would you like to hear how we made hinges in the old shop thirty years ago? Of course I know that yours is a progressive paper, and it may be out of place to speak of the way in which work was done so long ago. However, this might be used to show the contrast between the old and the present methods. The hinges that I have in mind made a job that we had to fall back on when work was slack or to fill in (or fill out) our spare moments. There was a hardware dealer in town who contracted for about 10,000 of these hinges to be delivered at any time in installments of 100 pairs; and so, whenever the "smithy" announced to the boss that his sole occupation was "cutting wind" he would be met with a sweet smile and the never-failing reply: "Well, what's the matter with a couple of hundred acorns until something else turns up?" By "acorns" he meant the hinge pins with acorns on the ends.

These had to be swaged. The heaviest pins were made from 7-16 inch iron. The end was doubled up for about 1 inch, and with a welding heat the "acorn" was formed in the swage, the smith holding the swage and one of us boys with a sledge impersonating the trip hammer. It was hard work, and in the summer time we used to get up at 5 o'clock in the morning and have a couple of hundred acorns swaged by eight o'clock.

But most of this work was done in winter and then it helped us to keep warm, no other method of heating having been thought of in those days. For the hinge proper we had strips of iron of the correct width marked and cut as in Fig. 1. The strip was cut across, as shown at *a a a* in an old-fashioned pair of shears that were put up in the vise. These shears had a long handle that came out under your arm, and you gave this handle a yank that sometimes almost yanked your arm out of its socket. We cut next, as shown at Fig. 2, from both ends to line *b*, which had to be cut with a chisel.

After separating the two pieces they were given a shape something like *C*. Then they were ready for the curling-up process shown at *D*. The die, which was made of steel, with a hole through it a little larger than the outside diameter of the finished hinge, had a slit to admit the blanks. We slid them in from one end, and five or six blows with a light sledge would curl them up nicely. Care had to be exercised though to hit the edge evenly, or they would curl up askew. Our hand press was used for punching the holes and they were countersunk on an improvised speed lathe with old-fashioned treadle.



HINGE MAKING IN AN OLD SHOP.

Talk about hard work! The boss and two boys would make fifty pairs of hinges complete in two days, although everything in that old shop had to be done by hand.

C. H. M.

Annealing in the Lead Bath—Hardening Without Tempering.

Editor American Machinist:

I have been much interested in the articles on hardening, by Messrs. Markham and Bacon, because they are valuable contributions to the craft's stock of knowledge and again because I have had some experience similar to that of these gentlemen, and can therefore endorse their methods. I don't feel that I can add to Mr. Markham's article except in suggesting another and perhaps a directly opposite use of the lead bath, and that is for annealing or softening parts of hardened articles, either for performing further operations or for strengthening something where it is not necessary for it to be perfectly hard.

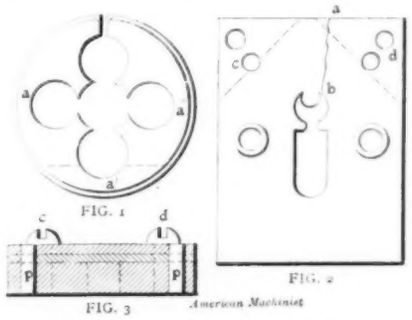
As an illustration: Fig. 1 represents a die for screw cutting which needs only be hard at the cutting points, while *a*, *a'*, *a"* are better with a spring temper, which is of course much softer than is permissible for the cutting points. If this die is dipped edgewise in a bath of melted lead, to say the dotted line, this part can even be annealed without altering the temper of the cutting points to any appreciable extent, providing the lead bath is hot enough, and perhaps red hot at that.

I had a blanking die to make, like Fig. 2, which broke along the line *a b* while working the punch into it, and, as it was more or less of an experimental job that it was intended for, I wanted to save it if possible. *c d* are the screw holes for gage and stripper. I went about it as follows: I heated a ladle of lead to a good red heat and dipped one of the corners of the die into the bath, about to the dotted line, and left it immersed thus far until a blue began to crawl up the die, and then dipped it into water with the opposite or cool corner first, dipping it far enough to prevent the heat from the corner reaching the cutting edge, and allowed the corner *c* to cool slowly. When done, I repeated the operation with the other corner *d*. I found that I could now drill the two small holes near the corners. The purpose of these holes can be seen by Fig. 3, which is a sectional end view of the repaired die. The holes through the stripper and gage plates were drilled a trifle closer together than the holes in the die, so that when the pins *p p'* were driven the crack was drawn shut. The die is still doing duty and gives no indication of weakness. This principle of annealing, I think, can be applied on many other articles, and among them perhaps there are tools which can be improved upon by the addition of something placed where to have the temper drawn would not matter. One's own ingenuity or needs will suggest different uses.

In reference to Mr. Bacon's method of hardening in water and oil, I would say that I hardly believe that he proposes it with the idea of giving us something radically new in hardening, since almost similar methods have been described before in the columns of the AMERICAN MACHINIST, with the difference that Mr. Bacon acts more boldly and "draws" or tempers the piece with but one application of heat—that in the heating for the hardening.

I have often used the method of first dipping the piece to be hardened in water, and when sure that the cutting edges or wearing surfaces, as the case might be, were perfectly hardened, and before the other and less important parts lost very much of their heat, transferred them to the oil to cool less quickly, and allow the piece to become cold, or at least as cold as the oil would allow, and then tempering them as a separate operation. By this method I have successfully hardened many tools and other pieces which might otherwise have gone to the scrap box or have had ugly flaws. With Mr. Bacon's improved method, I can see possibilities of further reducing the chances of failure.

And now, in regard to the old, old method of first heating pieces, large and small alike, to a good "red" heat or a nice "cherry red," etc., and dipping in water, and polishing so that later, when tempering, you can judge the temper by the "straw," "yellow," "orange," etc., usually prescribed for different tools, and then, after all, finding that you have something too soft or perhaps too hard for the work in hand. Is this the best method after all? I think that many are agreed that it is a pretty fair one, but a little too uncertain where exact results are demanded. Let a piece of steel, hardened in the usual manner, be polished so that the surface is left *perfectly dry*. Now touch one or two spots with the finger, or perhaps, better yet, rub it with a finger which is a trifle oily; very little oil is necessary. Heat the piece on a hot plate, or anything that can emit *heat only*. (Gas flame or a forge fire will not do for this experiment). You will notice as the piece begins to heat that the finger marks color first, and in some instances assume a dark yellow, or even a brown in extreme cases before the perfectly dry parts show color at all. Thought I admit that I am citing a somewhat extreme case, which color are you going to be guided by? Surfaces polished with new and dry emery cloth usually show color slower than those polished with old and slightly greasy emery cloth, all other things being equal.



ANNEALING IN THE LEAD BATH.

The heat from a muffle bar or a plate will produce an effect different from the gas flame (blue flame, I am speaking of now) or the heat from a coal fire, especially when a gas is being thrown off with the heat. Other circumstances might perhaps be cited to show that in a case of this kind "seeing" is not always "knowing" or even a good ground for "believing." A file test is to be relied upon more than color or many other tests. This would suggest that the surest way without the file test is to place the hardened piece or pieces in an oil bath and bring the whole up to the temperature that would usually produce any particular color in the open air that the piece requires.

Of course, a thermometer reading up to 650 degrees Fahr. would be about the best thing with which to determine these temperatures—which best temperature may be found by experiment, the tools or pieces being taken from the bath when the predetermined temperature is reached and allowed to cool. Of course, at whatever temperature the bath will impart the best temper it should be recorded, supposing that in hardening about the same heat is attained in all cases, so that if future occasion requires it pieces can be given a similar temper.

But now, after all is said and done, what is the use of tempering *everything*, anyhow? We admit that there are many things that cannot be hardened to the proper degree of hardness without this second operation—I mean tempering; but why not leave out the operation when possible? Directions for using Styrian steel, for instance, advise, in some instances, lathe and planer tools, for example, to be hardened at as low a heat as the steel will harden at, and use the tool without tempering at all. I have followed these directions in the use of many of the high grades of tool steels, and get slightly different results with different brands of tool steel; but all seem to show that tempering is, in many cases, an unnecessary operation. By actual experience I have demonstrated, to my own satisfaction, that it is possible in most cases—as with some cutting tools, for instance—to give the piece a low and even degree of heat that, when cooled in clear water, would have a hardness that fulfilled all requirements and wore better, in many cases, than tools that went through the usual process, and this without tempering in the least. Stubbs steel seems to be very susceptible to the different "initial" heats. As hardness depends largely upon the rapidity with which a piece can be lowered from a high heat to a low heat, light pieces require less initial heat than quicker and heavier pieces, and for this reason light pieces can often be hardened to the proper degree at an incipient red or a dull red heat, since in such cases the heat is withdrawn from the piece

almost the instant it comes in contact with water.

Steel hardened at a low heat usually shows a fracture free from any indication of crystallization. It is not to be understood, however, that I mean that this treatment corrects steel that has already been crystallized by a heat too high for it. Best results in hardening can be obtained by having the heating forge located in a dark place, or at least where the light is quite uniform. The forge in a dark place possesses the advantage that slight changes of color in heating are more easily detected, and the operator has better control over the steel in consequence. If anyone wishes to try this method, let me advise an *even* heat, meaning by this a heat that is even throughout the piece; and don't expect to get this in a jiffy, but take time to heat thoroughly before dipping, as much depends upon even heating.

HAR. D. NING.

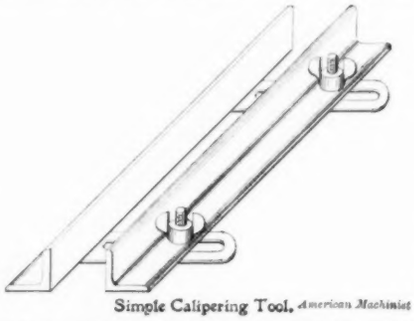
Taper Gages.

Editor American Machinist:

The taper gage, page 202, suggests an older and simpler form for rough work, which was illustrated in your paper so long ago that it will be new to some of your readers. It was used by the blacksmith in forging taper keys, and consists of two pieces of 1½-inch angle iron fastened together as shown in Fig. 1, which is reproduced from the AMERICAN MACHINIST of July 14, 1883.

It seemed that it might be used as one of the many illustrations of the value of your paper to all of us who are trying to become more expert mechanics. The AMERICAN MACHINIST is a toolroom in which all the tools are named.

The criticism of the gage shown has been mainly that it may be tampered with by men in the shop. Mechanically, one objection to its use for accurate work is, that no means are provided for placing the piece to be gaged in a true horizontal position. For most turned work this objection would of course be considered mere "hair splitting." The term "accurate work" is only relative. A thousandth of an inch is in many shops a quantity to juggle with. Accuracy to the thousandth, or perhaps part of a thousandth, is called for in specifications and as rashly promised by salesmen. The attainment of this accuracy is another matter, and when required in jigs and gages, it means a study of available shop tools and men capable of producing it.



Simple Calipering Tool. *American Machinist*

FIG. 1. FROM AMERICAN MACHINIST, JULY 14, 1883.

To bore a hole which shall be true in taper and exact to size is not so easy as at first appears. The difficulty in doing this and the desirability of an adjustable gage led to the use of the following form, shown in Fig. 2. This gage consists of eight hard steel blades carefully ground and mounted in a frame composed of the two standards and the bottom plate. Each blade has an adjusting screw in each standard and is clamped in position by the taper bolt between each pair of blades. The distance from the center to the base was made to correspond with that of a pair of planer centers. The gage was then set to an accurate plug held between the centers. In the gage shown the blades were about 12 inches long, 1¼ inches wide and ¼ inch thick.

The gage is used for testing drawn brass cases, which, from the character of the material and operation, are neither uniform in taper nor a true circle in section. These variations are small, but with a gage of this form they can be readily observed. Of course, when used as a simple "maximum" gage or "must-go-in," fewer blades would be sufficient. Being used by an independent inspector there is no temptation to tamper with the adjustment.

JAMES A. BROWN.

Frankford Arsenal, Philadelphia.

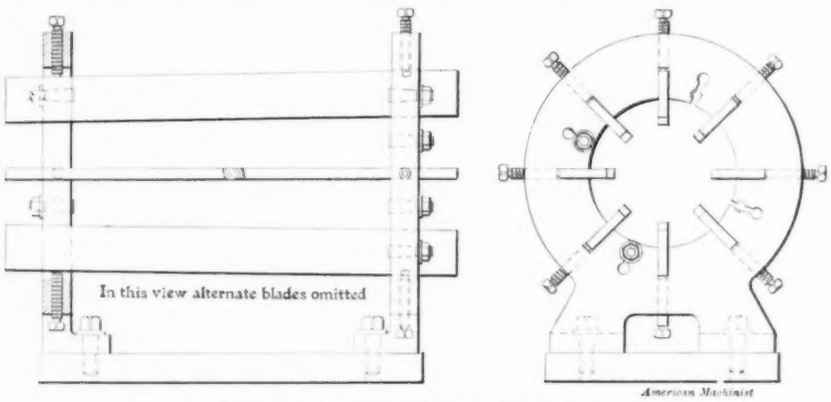


FIG. 2. TAPER GAGE FOR ACCURATE WORK ON BRASS SHELLS.

Grinding Tap Threads.

Editor American Machinist:

Referring to the article on "Machining Conical Shells" on page 18 of the current volume, I would like to inquire what does L. O. W. mean by having to grind the taps? It is not quite clear what is meant, and I have inquired of several other readers and none can say for sure what is meant.

M. H. WESTBROOK.

Editor American Machinist:

In answer to Mr. Westbrook's inquiry I would like to call his attention to the accuracy necessary in the pitch of the thread of those taps, the error in the pitch being one of the main troubles we had to overcome on the job in question. The screw or pitch gages, as well as the plug screw gages, the government furnishes on such jobs are all hardened, and the thread part of them is ground, which leaves them as near perfect as anyone will wish to work to, and our taps had to make an exact counterpart of the government gages.

The inspector's method was to have a piece of casting tapped with the tap, put his stamp on both sides of the casting, put the tap in his pocket, try his gages into the thread and if satisfactory have the casting split in two lengthwise, then with Prussian blue pigment for marking roll the gage in the thread; if it showed bearing all over he would stamp the tap and return it to us and destroy the stamp on the casting (this last I suppose was to make sure that we would not ring the same casting on him two or more times); if the thread was "off," the tap was returned unstamped and consequently we could not use it.

Now, it is reasonable to suppose that no matter how carefully or accurately a tap is made it is going to alter somewhat in the hardening, and in fact change its length to a certain extent. In actual practice I have found that extent go sometimes in one and sometimes another direction; therefore, if the length changes, so does the pitch; if the diameter changes, good-bye to size. So it was "up to us" to devise some way to overcome this difficulty and be able to swear by the result, and the only way anyone in our crowd knew of was to do the same with our taps that the government was doing with its gages, viz., grind the thread to shape, size and pitch.

To accomplish this we made (not designed) a grinding fixture to fit the saddle of the lathe in which we made the taps, and as a brief description of the same is not out of place here, I will try to do it justice. Unfortunately, I have no data concerning it except those in my head, but as I was chiefly concerned in getting it up, and also in making it, I ought to be able to give a fairly comprehensible description.

It mainly consisted of two parts: a frame which fastened to the saddle of the lathe, and a head that swiveled on said frame.

on which were the spindle bearings. When the head stood at o the spindle was parallel to the center line of the lathe, but when set at any angle it would still be parallel to a plane of the center line, but not parallel to the plane of the shears of the lathe; therefore, by simply varying the angle to suit, we could use it for any pitch, right or left.

The center of the wheel, diametral as well as facial, lay in a straight line which passed through the center of the pivot upon which the head swung; consequently, no matter what the angle the head was set at the point of contact of the wheel and the work remained constant, thereby insuring the correct angularity of the thread. To turn the correct shape on the face of the wheel we had two guides for a small saddle block which held a diamond movable at right angles to its sides. These guides set on a projection cast for that purpose on the head, one end swiveled on a pin common to both. The center of this pin was in line with the facial center of the wheel; therefore, also with the swiveling center of the head, and the other end was fastened through a milled slot on a graduated surface. If both guides were set to 90 degrees, they formed one straight guide, and the diamond saddle slid over it would turn the wheel off at right angles to its sides. If each was set at 60 degrees, it would turn an angle of 60 degrees on the wheel (30 degrees to each side if taking a cylindrical face on the wheel as o degree). Thus it can be seen how easy it made the finishing of those taps, and where such accuracy was necessary it turned a rather mean job as my friend the plumber would say into a "lead pipe cinch."

The wheels used were carborundum of a very fine grade. It was at first thought that we might have to make copper ones with diamond dust as an abrasive, but this was found unnecessary, it being so easy to keep the wheels up to shape. There were two plug screw gages: one was + .0005, the other — .0005; the gage had to go in by hand, but if the + gage went in only ½ inch the shell was rejected.

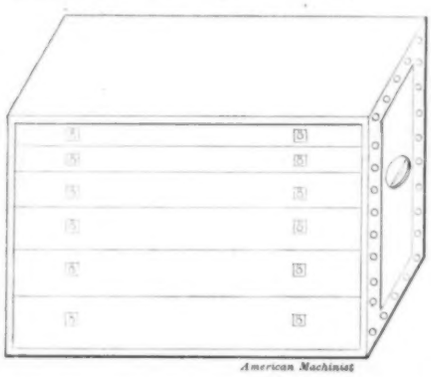
L. O. W.

A Portable Case for Patternmakers' Tools.

Editor American Machinist:

On page 344 "Hobo" suggests the use of a trunk as a tool chest. This would have a nice appearance to one traveling, but when moving around, a fellow does not always find all the modern conveniences, and quite often he has to use his tools right from whatever he brings them in, so he should have something easy to get at.

The sketch shows a case of drawers which is handy. At the end of the bench it serves simply as a case, and if there is not room it will go under the bench out of the way, still being convenient. There is not so much trouble making one as in making a chest, and it does for case and chest combined. It is surprising how much can be gotten into a very small space without crowding at all, if calculated right. The top drawer is just the



PORTABLE CASE FOR PATTERNMAKER'S TOOLS.

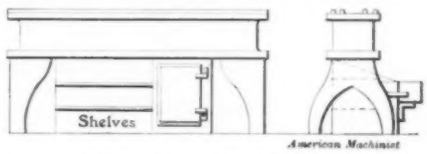
depth of the saws, the bottom one deep enough for a jointer, and all of them long enough for the longest saw. When traveling, the front is locked and screwed on, keeping everything in place. It is about the most convenient arrangement I have seen for traveling.

C. FREMONT.

Another Chip Pan for the Lathe.

Editor American Machinist:

The article by T. H. Miller, "Arrangement of Chip Pan," brings to my mind a similar device that I had made while I was trying to learn the trade. In this arrangement of mine it was not necessary to have the pan extend the entire length of the top of shelves. Chips, oil, etc., falling on the inclined top, found their



CHIP PAN FOR THE LATHE.

way to the movable box in the rear, where box and chips could be removed or a separate box placed for catching brass, copper, etc. This arrangement gives more room in front and is easy to clean.

"TRAMP."

Defending and Encouraging the Apprentices.

Editor American Machinist:

I have been considerably interested in the various articles on the apprentice question which have recently appeared. One or two of the writers I have thought I would like to serve my time under were I to commence the trade over again; as to the others, I would rather not.

The element of patience enters into the problem somewhat on the part of the foreman, in order to bring out the best there is in a boy. It seems to me that the discussion has reached a point where the boys themselves would want to say a word, if they have found out that anything is the matter. Perhaps they realize occasionally that something has hit them; but they will have to look back through the years to learn what it is.

It is undoubtedly a fact that many people are, through their own misunderstanding of themselves, or through the choice of those who have influenced their start in business life, misplaced in this world, and it is a very sad condition of things when people spend a lifetime as indifferent workmen when they had natural abilities that would have made them successful in another line. I think, however, that all has not been said about the three months' probation for prospective apprentices. Without doubt any foreman could in that time tell whether he wanted any given boy to work for him, but I question very much whether the average foreman or employer of boys could in nearly all cases decide that the boy was not competent to become a good machinist, and do anything like justice to the boy. Boys have a way of surprising people; they also have a way frequently of finding themselves, as it were, waking up gradually or otherwise to the necessity of hard work, of getting an education and of making a special effort all along the line to fit themselves for better things, and the machinist's business is quite as likely to arouse a boy as any other occupation. I believe in this connection that a great many of the satisfactory workmen, those classed from good to the best, would, if they could have got the opinion of their foremen at the end of the first three months, have been much discouraged.

A young man came to me a few years ago, who had been in the shop much more than a few months, and who had been trying to get his pay raised. The foreman told him that he could not give it to him, and also told him some other things that the boy did not ask for, and among them that he did not think it much use for him to try to learn the machinist's trade. Well, the boy was a little nearer broken hearted than I should think it would be good for anyone to be very often, and he thoroughly believed what had been told him. However, he kept pegging away and has since held down two jobs in a satisfactory manner that were considerably better than his boss was holding at the time we speak of.

How would it be if only the ones who seemed the best qualified were given a place in the shops? They could not all be foremen, superintendents and general managers. The sort of people that I have an idea the three-months-trial system is after will many of them, when they find what the prospects are ahead of them, leave the trade for something that pays better and with more than even chances of success. Machinists have a way of doing that occasionally, and it is not the indifferent workmen usually who do it. The case of the boy Corneil Ridderhoff speaks of, on page 199, Vol. 25, who worked in a machine shop three years and then did not know how many thirty-seconds there are

in an inch, seems to be a pretty hard case, but even then it appears like a pretty broad statement to make that he is not fit for the business. Who is to say how much, or specify the things that a person is to learn for himself in a given length of time? What man does not have brought to his attention more or less frequently things he does not know and who is astonished at himself for not having picked up those items of information before?

Another case Mr. Osborne tells of on page 112, Vol. 24, of the boy who calmly threaded a lot of ¼-inch pipe nipples with a ¾-inch bolt die. This must have been very annoying to the foreman, and he might have felt a little to blame himself for not seeing that the boy was started right. It appears like a hard case, but there are lots of good men that have done things worse than that. We have another good illustration of a man not being familiar with something he could reasonably be expected to know, on page 194, Vol. 25, where the superintendent thought it impossible that the product of his tools could have left-hand threads, as they had no lathes that run backwards to cut such

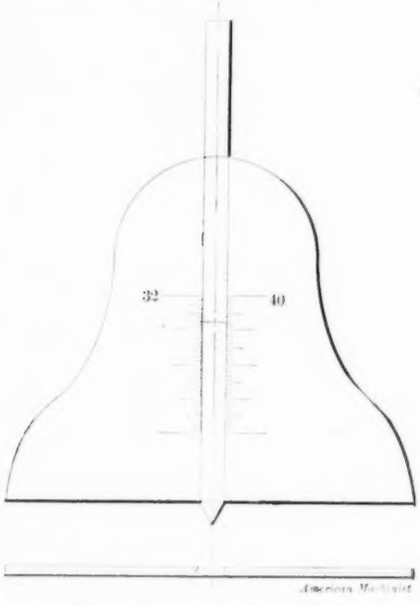


FIG. 1. A FLAT DEPTH GAGE.

threads. Perhaps if he had been a boy he would not have had brains enough to learn the business, and yet he was evidently holding quite a good position and was quite likely making money for the concern that employed him. It really looks as though the boy was the under dog and was being picked upon; however, I am not defending apprentices in being afraid of work, careless or any of the like things.

If all learning the trade would observe the list of don'ts on page 186, Vol. 24, prepared specially for them in one of our shops, it would go quite a way I think towards making up for a few brains the foreman might think was lacking. I would add another don't or two. Don't, as you prize your chance to learn, do anything to annoy your boss. He probably thinks he is up to all he can stand without being annoyed by boys whom quite likely he is doing all he can to help, and don't deceive him by keeping things from him that he ought to know. There are some very good points for apprentices on page 473, Vol. 24, also by Mr. Osborne. The article on page 1244, by B. W. T., very nearly presented my idea of giving a boy a chance. Finally, to quote again from the article on page 112, Vol. 24, "Watch everyone as though no one knew anything and as though everyone was trying to do wrong," and, for the sake of harmony, do not let some people know you are watching them.

N. A. C.

A Flat Depth Gage—A Micrometer Depth Gage.

Editor American Machinist:

At page 345 "Theodore" describes a depth gage. I would like to submit a couple. The first, Fig. 1, is like one a friend of mine made. The sketch explains itself sufficiently. This gage is very thin and takes up little room in the kit. Fig. 2 shows one I made for my own use a year or so ago. The bars can be made to different lengths to get any measurements over an inch. I find it a very handy tool.

A. C. F.

"Boys" in a Drafting Room.

Editor American Machinist:

At page 202, "X" writes about "Characteristics of boys and men" and brings back to my memory a few of the experiences I have had or have witnessed. Not long ago I was employed as a draftsman in a large establishment in Cleveland. It was one of these "at home" shops. Did you ever work in one of these "at home" shops, where you are pleased to go to work every morning on time, willing to do a good day's work, quit in the evening fresh as a daisy, because the *deck hands* know their business?

Matters changed in this shop, a new foreman was employed and he was in a short time promoted to be assistant superintendent. He was well acquainted, not with his business, but with a number of influential business men. To follow the old-time custom, he began to cut expenses and started at the boy in the drafting room. When this boy was in the drafting office he took a crack at any old thing, picked up drawing pretty well and learned the way things are done in a real drafting room. This boy was a bright fellow, and was fair at drawing; but, like a number of mechanics, young and old, you could not drive him out of this office with anything less than a Gatling gun. The new boss touched off the "Gatling gun" and it struck the boy.

Before his departure he came to say good-bye, and I took him one side. Said I: "You are a good boy and fair at drawing, and a great many offices would be glad to have you. How much are you receiving in this office?" "Five dollars a week." "Well, you ask for eight when you are asking for a position." Six months after I saw the boy. He got his job and the eight dollars, and he had a letter of reference that would start a fire under a furnace.

The new boss soon saw that it was almost impossible to get along in the drafting room without a boy, so the usual ad. appeared in the paper next day, as follows: "Wanted—Boy, about 18, who understands work around drafting room, one who has had a technical school training preferred."

I think every boy in Cleveland answered

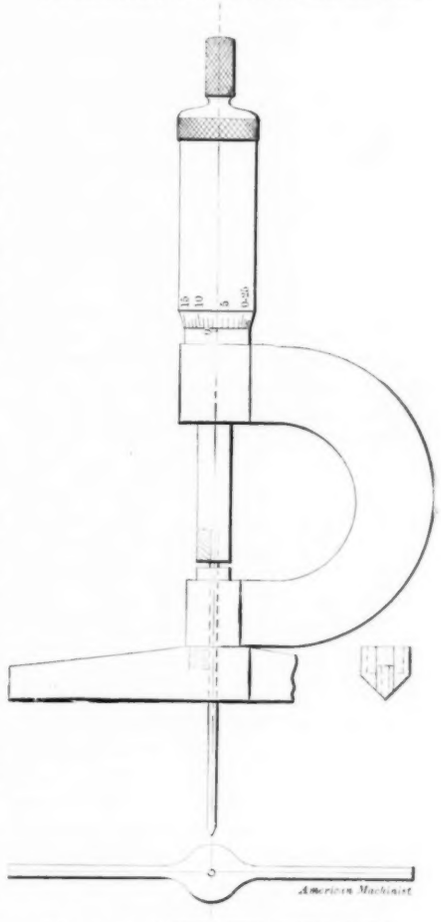


FIG. 2. A MICROMETER DEPTH GAGE.

that ad. No. 1 was called before the new boss. Was he a hair splitter? he knew more than the man who wrote the book, and at drawing, why, he received a sheepskin at college for drawing; and as to the care of an office, he was a regular cyclone on the end of a broom. He got the job. Everything went well for two weeks, or until one day when during a rainstorm one of the draftsmen asked him to go to his house and get his rain coat, at the same time giving him his car fare. "See here," said the new boy, "I want you to distinctly understand that I am a draftsman; I came to Cleveland to work as a draftsman and not as a truck horse." Just then the air was full of feet. I threw one of mine, but I think it struck the leg of

a drawing-board or a brick in his pistol pocket; I could not get my shoe on for a week after.

The new boy was getting on to the run of the work when a request came from the manager of a packing house in Omaha to send a draftsman, as they wished to make some changes in their machinery. The machinery referred to was built by this Cleveland firm. The "new boss" thought it would be good experience for the "new boy" to take charge of this Omaha job, and gave him notice to leave on the 2 P. M. train. The "new boy" at once went to his boarding place, and in about an hour returned to the shop with a *tog* that would frost Prince Henry. He started for the packing house. When he arrived and saw the machinery he took the return train for Cleveland. The "new boy" was under the impression that the machinery in a packing house was kept up the same as the machinery at college. On his return to the office he saw the "new boss," and he said: "You show a lack of judgment in sending a person of my education to do such filthy work when you have men here who are quite willing to do it." This was as far as he got.

About two days after a young man about 19, with a good-natured, smiling countenance, and hands that showed evidence of being up against the real thing, came to the office and asked for a job in the drafting room. He said he had spent two years in a machine shop as a helper and picking up all he could about the machinist trade, at the same time attending evening drawing school; would like to get into a drawing room where he could learn drawing and earn a few dollars to help support himself and invalid sister. He got the job. He was a splendid boy, the most willing boy I ever saw, always ready to accommodate. The following Christmas the draftsmen presented him with a fine set of drawing tools, and when I quit the office in May he was on the "high road to success."

There is nothing like an education—mechanical or professional—but what's the good of a young man's throwing out his chest and thinking every other young man should be a "side stepper" when they see him coming, because he got a diploma from a mechanical training school.

If I were the father of a dozen boys I would have them learn some trade and at the same time take advantage of the opportunities afforded through the correspondence school to gain a technical education, and keep up to date by reading up-to-date mechanical literature; when you read the AMERICAN MACHINIST you are not far from the *date*. Give me the boy with this make-up every time. B. M.

Molding a Rope Sheave—Core Prints—Long Bosses.

Editor American Machinist:

On page 200 of the current volume is a description of how to mold a rope sheave in a two-part flask. Now, strange to say, a few weeks previous to reading this, I had written up the self-same idea, and of course it is now useless to send it to you.

I was describing the coincidence to an old molder over here, when he spoke of having molded these sheaves in exactly the same manner thirty years ago, and also described a method of molding the same

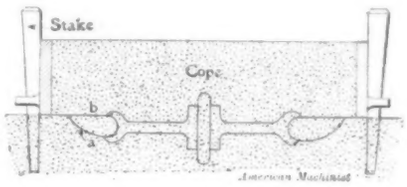


FIG. 1. MOLDING A ROPE SHEAVE IN THE FLOOR.

in a *one*-part flask (if I may use the term), *i. e.*, in the floor.

This method is shown at Fig. 1. The joints *a* and *b* are parted with paper. The cope is removed and then the upper half of the pattern. The joint *b* is then "clay-washed," and the cope is replaced and time is given for the clay-washed surfaces to adhere to each other. The cope is again removed, drawing with it the core which forms the groove, and then the lower half of the pattern is drawn. The mold is finished and the cope is replaced ready for pouring.

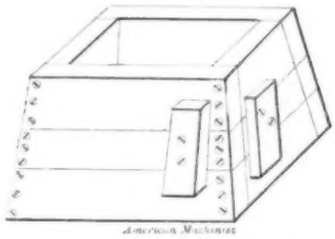


FIG. 2. THREE-PART FLASK FOR SMALL GROOVED PULLEYS.

Talking of rope sheaves, an order had come in for one gross of small sheaves for pulley blocks. From what I remember, they were about 5 inches in diameter and would average 3-16 inch thick in the groove and plate. As usual, they were required "at once," and we had no small three-part flasks. What must we do? "Send the order back," said the foreman. "We mustn't spoil a good customer." So I set to work the little brains which the foreman

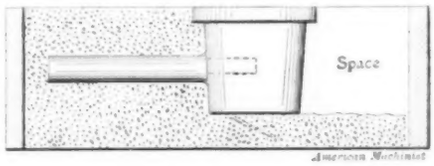


FIG. 3. DRAWING A LONG SIDE PIECE.

no doubt considered I possessed, and devised this method:

I made a rough three-part wood flask as Fig. 2, with guide pieces attached to the middle part at opposite corners. The sheaves were molded in this in the usual manner; the mold was placed on a prepared soft-sand bed, and the flask was with-

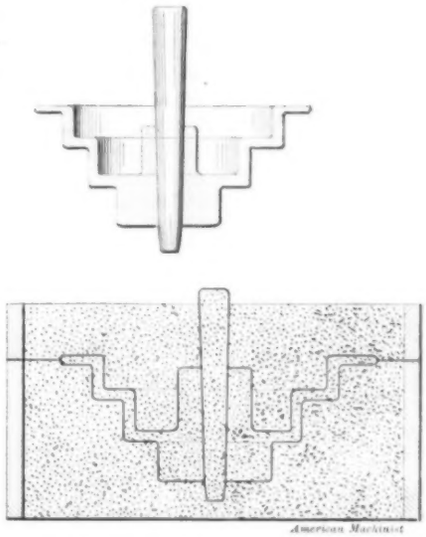


FIG. 4. USING A LONG TAPER CORE.

drawn, which was done easily, owing to the tapered sides. The top was weighted by short ends of flat bar iron placed at each side of the runner.

Often we have bosses or projections on the sides of patterns which are too long to draw in after the pattern body is drawn, and it is customary either to pocket over the projecting parts, making extra jointing, more work and greater risk, or to cut the boss, etc., into several portions, making it difficult to withdraw the more remote parts or to keep them true. Fig. 3 shows a pattern of this character. This difficulty is got over by ramming up only as much of the mold as shown, then removing the pattern sideways to draw the boss. Replace the pattern and continue as usual.

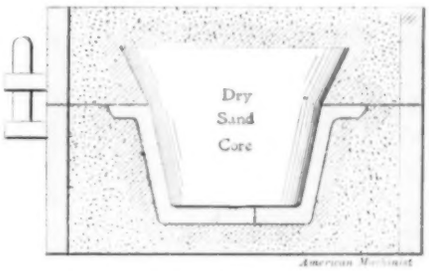


FIG. 5. SETTING THE CORE IN THE PATTERN.

Fig. 4 shows a form of core print to draw through the top of the mold, leaving a hole through by which it is possible to get the core accurately fixed and the vent hole in such a position that it is impossible for the metal to get in when the runner is close to the boss.

To insure cores being correctly set, it is often possible to insert the cores (dry sand) in the pattern, allowing them to project into the green sand in such a manner that the pattern may be drawn from

them, as shown in Fig. 5. Care must be taken not to ram the core hard into the pattern. FRANCIS W. SHAW.

Birmingham, England.

Catching Threads—English Workmen on American Lathes—Casting a Cone Pulley.

Editor American Machinist:

As I read W. Osborne's chatty "Echoes from the Oil Country," Tecumseh Swift's philosophical reasonings, and your other valuable contributors' letters, the first few words lead to an interest and a desire to read on. I must plead "guilty" to a liking for these chatting articles and letters. One can almost imagine himself right with them, and going through their experiences. Immediately upon the receipt of my copy from the news agent, I turn to "Echoes from the Oil Country," and if it isn't there I feel disappointed. I don't know much about the "Oil Country" and all I do know is from Mr. Osborne; but I should say that if it brings up many like Mr. Osborne it's a good place to get to. One must there use the contents of his brain box, and by constantly doing so becomes an expert.

If a young man just starting in life lands into a shop where a host of others are doing the same thing he is extremely likely to follow them closely, never asking himself why a thing is done thus, or the other way, and even if he was a bit original and attempted departures from the "cut and dried ways" the sneering of the other fellows would soon take the originality out of him. I was in charge of a jobbing shop where anything was taken in from a small shop tool to a gas meter. Being only a young fellow and having had only a general experience, I had a great amount of trouble to get the older hands to follow my ideas. One of them after being corrected began to talk about "a boy teaching an old man who'd been all his life at the trade." This settled me for a while, until in fact I could find time to show him that the boy knew a thing or two after all. This brings me to W. Osborne's remarks on "Catching Threads" at page 177. I recall the cutting of a short, square-thread screw, 1⅛ inches in diameter, about 8 inches long over all, with 6 inches of threaded part; thread 1 inch pitch, ¼ inch deep, double. This being an "odd" pitch (the lead screw was ½ inch pitch), my friend was cutting it in the ordinary way in England: chalking the screw and the spindle end, starting and stopping his lathe every cut to get the screw and spindle in similar relative positions each time. When I found out that simply to cut the thread, nothing else, he had averaged 1¾ hours each for twenty-four of them there was the "Old Harry" to pay. I tried to explain how I should have done the job, but, seeing that he had had twenty years' experience on the lathe he resented my interference. Mr. Osborne tells how the time saved by "timing" the various motions may be 50 per cent., but on this particular job, by personal action, I proved that a saving of 80 per cent. could be effected. What the man at his *best* had done in 1¼ hours I did in less than ¼ hour.

This property of "cross threading" proved an actual advantage in this particular job, the screws to be cut being 1 inch pitch, double thread, and the lead screw ½ inch pitch. After having run over it the first time, when we rack back, and again clasp the nut, it would be of particular advantage if the second thread could be cut with the same depth of cut or with the same set of the tool. To secure an alternate motion, I reduced the diameter of the end of the work by one cut, then dropped the nut. Racking back I placed the tool even with the reduced portion, and, keeping my eye steady, immediately after the thread first cut had passed the tool, down went the nut and the tool cut the other thread. Upon returning, the diameter was still further reduced at the end by another cut, and the same proceeding was followed until the final cut.

Personally, I never had any instruction whatever on the lathe. What I know I picked up, as it were, by the trial and error process, gaining experience from misfortune.

It is now about eight years since I first saw daylight on a screw-cutting lathe. The lathe was a common (very common) Yorkshire lathe. First job I did was a plain piece of work. The second was something in the set-screw line with a ⅝-inch standard Whitworth thread cut on it. This is 11 per inch. I fixed up the lathe to cut this pitch, set my tools and started. By chance, I finished one screw without stopping the lathe. How it came to pass that the nut caught right every time I can only explain on the assumption that chance did it. I took it in the ordinary way, considering it was all right, and while getting another on the centers, I was congratulating myself upon the excellent job I had made of my first screw; but "pride goeth before destruction." I was just getting down to a nice depth, viewing with delight the appearance of a thread, when, crash! bang went the tool. I put it down to the back lash in the top slide of the slide rest, which was at right angles to the cross-slide, and I tightened it up. I fixed on a new tool and started again; but, try as I would, the tool would try to cut off the thread. "Now," says I to myself, "I cut the first without any trouble. How is it the second bothers so much?" I was misled into placing the onus on to anything but the right one. After much trial and failure, I saw that some rational reason underlay the thing, and it set my wits to work. "It can't be the tool, slide-rest or headstock; that's evident, and if it's the change wheels it must show on the screw." I had the damaged screw still in the lathe. Fixing a new tool against the thread when the nut was clasped, I thought: Suppose I lift up the nut, advance the saddle one thread and re-clasp the nut, where will the tool come? I have it. The tool will advance 5½ threads. So it *must* have been chance that cut the first one right. Now, how can I arrange to get the nut right every turn? Let's see. Suppose I run up cutting, then rack back, and run up again idle, noticing where the tool would cut and then rack back at the same speed as I did before if the tool is correct, but delay a little if the tool is incorrect; that should put the matter right. In fact, to chalk anything was never thought of. Now, what's the use anyway of the index on the screw collar in screw cutting? In cutting left-hand threads we have only to "feed in" until we have sufficient cut on, while the lathe is running. For right-hand threads we can reduce he end by a cut and then drop in the nut, as previously explained.

Some years later, when we had "got on," we bought an American lathe. We started a man on it who had been used to running American lathes. What did he do to start with? He took off the stops that actuated the automatic trip motion. Although the top slide of the compound rest was fixed parallel with the bottom one, he turned it at right angles. The stop on bottom slide he took off also. "All in the way," he said, and he was using that lathe in the English way, traversing for turning parallel with the top slide, when I stepped up. Having been a reader of *Ours* then for some time, it didn't take long to find fault, and I wanted to know where he had gained his knowledge in the use of American lathes. "At so and so, and so and so," he said; "we always used them so there." "You didn't use them rightly, then." And I had to explain the whole rigmarole, but even then at times I caught him going along in the old ruts.

I tell you when going through shops here to watch the men at work—the majority of them, too—makes me feel sick, and I feel like taking the work out of their hands and doing it myself.

That "fillet gage" shown recently is very common here; in fact, I have one myself, but I use it only for setting dividers on.

The way they talk here when the talk is about speeding up is: "Well, what will it advantage me if I get more work out than so and so; I can do it if I like, but doesn't it pay me best to take it easy?" I've had that tale told to me twice this week, and as for talking about true patriotism being to better the country by doing your best—that doesn't wash, and you hear sneers of "Salvation Army" and "Evangelist." Do you know when I begin to think of these things I get down in the dumps? I like good work, and plenty of it, and that is the only thing that will save England. We are slowly—but very slowly

—improving, 'tis true, but "conservatism" still holds the day.

The account of that fellow who was too "learned up" to read the AMERICAN MACHINIST reminds me of an apprentice in our shop. He was sixteen years old when he went on to the big planer. He borrowed my AMERICAN MACHINIST, and when h had a long job on would ride on the table reading it. I believe he read it better than I read it myself. (He's taking it himself to-day.) In one issue there appeared an account of an appliance for raising the tool when undercutting. He happened to be planing a lathe bed the day he got the paper. Before he got to the undercutting business, he had made a lifting apparatus, simply a plain hinge fixed behind the tool, allowing the end to stand down below the tool. When that had been on the machine three months, we could give him any job that happened along and he would carry it through successfully. On the lathe and in the foundry he was equally successful. He seemed to advance in a few months almost to perfection in anything he put his hands to. He made (in the foundry) some rope sheaves in exactly the same manner as explained at page 200 by Wm. Newton. No matter what the job was he would do it, even if he went back at night and worked till 10 or 11 o'clock (without pay) and the castings he made were without doubt equal in appearance to those made by the best molders, and in competition with anyone four or five years older than himself, both in speed of execution and quality, he could beat them hollow. Although now only eighteen years old, he is working a 24-inch screw-cutting lathe and doing better than many men who have been a lifetime at the trade.

Now, there is a lot of rot talked about being "Jack of all trades and master of none" if we attempt more than one job or rather class of job. I say if a man is capable of learning only one trade he will never really be a master of that one, and I see no reason why a particularly sharp person should not be able to go right through with the trade of machine building right from office through pattern-room, foundry and machine shop, and give a start to one who has stuck, say, to turning all his working days.

That cone pulley—the molding of it: Has anyone ever tried using a flask divided into as many parts as there are steps and two more for top and bottom parts, and molding the large end down, drawing each part separately and leaving the core standing in the mold? Of course, I mean when there is a core through to take off the gases. If not, try it and be surprised at the saving in time, or finishing particularly, over the old method. No long lifters or gaggers and danger of leaving most of the core down in the corners. The outside, with care, can be lifted off without any damage. And you won't be troubled with a thin and thick casting by the core getting misplaced.

FRANCIS W. SHAW.

Birmingham, England.

In Defence of the Backing Belt.

Editor American Machinist:

At page 177 is an article by W. Osborne, in which he discusses "catching threads," and says that he finds it makes a difference of 50 per cent. in cutting ordinary threads. Let us investigate. Mr. Osborne mentioned the cutting of a tap with 11½ threads per inch, and he stated that the lathes he used had lead screws ¼ inch pitch, and that he could run the rest back while the lead screw made two rotations. As 11½ and 4 per inch match at 2 inches, the rest would be moved 2 inches, or some multiple of 2 inches, if the lathe be stopped and the carriage run back to a mark or stop, which means that by this method about 1⅞ inches would be the distance that could be cut if the rest was moved to the first 2 inches, and a thread shorter than 1⅞ inches would require the same amount of time. Running back while the lathe is running during the time of two turns of the lead screw shortens the cutting travel ½ inch, enabling a screw 1⅜ inches or less in length to be cut in a shorter time, equal to the time of two turns of the lead screw. But if the screw should be 1⅝ inches long it would be necessary to run back 4 inches and to cut wind 1⅜ inches. Stopping and moving back to a mark or stop would in this case save time. As 11½ threads per inch is a standard pipe thread and used almost exclusively on such work, the length of thread rarely exceeding ¾ inch, it follows that, by either of the above methods, about half the cutting would be on wind; in one case ⅝ inch, in the other ⅞ inch being lost.

A lathe with a backing belt running at the same cutting speed and backing two to one, would cut the screw in four turns of lead screw and run back in the time of two turns, or in all six turns—perhaps a little less—while the best either of the other methods can show is eight turns, or a gain of 25 per cent. in favor of the backing belt, as compared with "catching threads." Take another case: A 1-inch screw, 8 threads per inch, to be cut 1⅜ inches. Assume the operator to be active enough to run back and get the tool in cutting position in the time of two turns of the lead screw. He will then be able to cut 1⅜ inches. Then the lead screw will turn six times during the cutting and two times running back, or eight turns for the cycle. As the nut will catch anywhere on this pitch, the conditions are the most favorable for "catching."

Let an equally expert operator try the same job with a backing belt arranged to reverse 2 to 1. Six turns will cut the screw as before, but three turns instead of two will be required to run back, so that the man "catching threads" would cut 9 screws while the man with the backing belt cut 8—a gain of 12½ per cent.; but as the time of putting job in and out of the lathe, measuring, trying on nut or gage occupies fully as much time as cutting and running back, the gain would not exceed 5 per cent., instead of 50 per cent. And these figures cannot be relied on for day in and day out work.

As a general rule, a man will perform about the same amount of work in a day, whether the work be easy or laborious; so that if he has two methods of producing a number of pieces, one of which involves the expenditure of more energy than the other, the number of pieces produced by the more laborious method will be less than that by the less laborious. Also, in most cases he will choose the easy way if allowed to do so. When cutting screws in a lathe with a backing belt, the operator takes the shipper lever in one hand and the handle of the cross-feed crank in the other. Two simple motions with each hand; four in all for each cut. Very little energy, either mental or physical, is required, and the operator assumes a posture easy to maintain. From the time he starts to cut the screw until he needs to try the nut or gage, he does not need to let go with either hand. In the catching operation the operator seizes the nut lever with one hand and the cross-feed handle with the other, and when the cut runs up and he has withdrawn the tool with the cross-feed handle and opened the nut, he must let go the cross-feed handle, hunt for the handle on the traversing mechanism, then run the rest back, find the cross-feed handle again, feed in the tool, close the nut and take another cut. The hand operating the nut has two simple movements; the other hand has the following movements: First feed in the tool; second, withdraw it; third, move to the traversing handle; fourth, traverse the rest; fifth, move to the cross-feed cranks; total seven, or three more than in the other case, and one of the three is running the rest back, involving more labor than the four required by the backing belt.

It is safe to say that the operator "catching threads" does fully double the labor, and in a stooping, tiresome posture, that the man using the backing belt does, to accomplish the same result per piece. And yet, in spite of the extra exertion, he can, under the most favorable conditions, gain not more than 5 per cent., and if the backing belt had been speeded 3 to 1, would not have gained anything.

According to the rule laid down above, the "thread catcher" will not keep up his gait; and in order to prove the case, I timed two "catchers" at work. One was cutting a ⅞-inch bolt, probably machine steel, about 1¼-inch thread. Time per cut, 41 seconds; cutting, 25 seconds; running back and catching, 16 seconds. The other was a 1¼-inch bolt, probably iron, about 1½-inch thread. Time per cut, 44 seconds; cutting, 19 seconds; running

back and catching, 25 seconds. These were cases that happened to come under my notice when Mr. Osborne's article happened to be in mind, and fairly represent everyday practice. In the example above I assumed the time consumed in running back and catching at one-fourth the whole time chargeable to one cut, but these test figures show, in one case, approximately two-fifths, in the other approximately five-ninths, which sustains the general rule as above.

This is not a new subject; it has been threshed out before I entered a machine shop. The backing belt was victorious then, so far as machinists were concerned. Managers who are not practical machinists—such, for example, as those mentioned by S. B. McQuade on page 194, same issue—are likely to favor "catching threads" and similar methods, because they see the man hustle. They fail to understand that it is not always the man who tears around, works hardest or tells the biggest yarn, who does the most work. Some persons appear prejudiced against the backing belt. It consumes a little power, and may be used to run the rest back in screw cutting, are the objections. I have written enough on the latter objection and will consider the other side. It is necessary to stop a lathe occasionally to do measuring, in which case the backing belt serves to check the speed and saves a minute or more. Often, when no backing belt is used, it is necessary to go to the cone and apply a brake. When changing face-plates or chucks the difference in time, between backing off by power and by hand, may be five minutes or half an hour. I have changed face-plates by power without help, when, if I had no backing belt, help would have been necessary. Between running a lathe with or without a backing belt the difference is not much, but the advantage is with the backing belt. JAMES BELL.

[Our correspondent presents a readable argument, but he begs the question generally in assuming the cutting of such short screws, and specifically in the case of screws 11½ to the inch. He says the length of thread on pipes rarely exceeds ¾ inch. As a matter of fact, from the time the tool is in position before beginning the cut until it is entirely withdrawn from the completed cut the length traversed must be from 1¼ to 1½ inches, or often more. It is convenient to have a backing belt on a lathe, and for short screws it is convenient and time-saving to use it but for long screws or for the average length of screws it is anything but a time-saver.—Ed.]

A Matter of Alinement—Reaming Straight.

Editor American Machinist:

The difficulty of grinding a long, heavy bar so that it will be truly cylindrical and straight, and of keeping it so after being put into daily use in the shop, is well known. A bar like Fig. 1 was once used for bringing two taper holes in a casting in alinement with a pair of scraped V-ways. The calipering was done by the fixture shown in Fig. 2, the same being

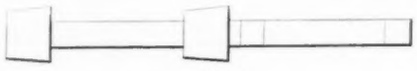


FIG. 1

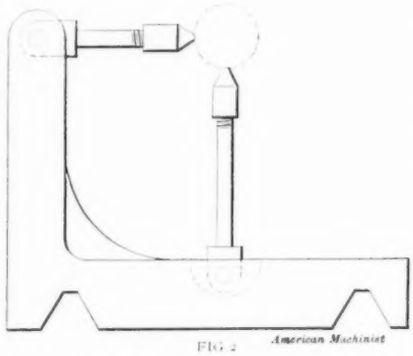


FIG. 2

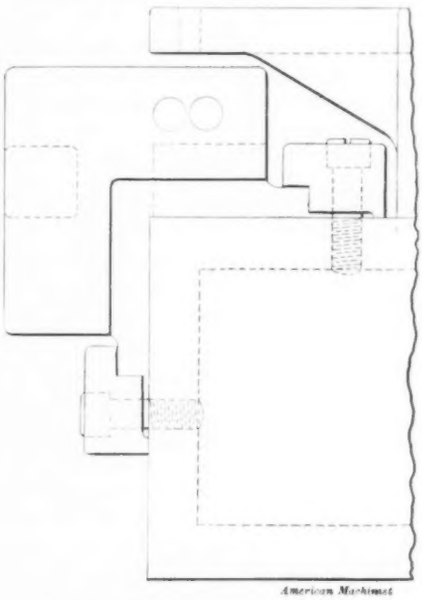
FOR TESTING LATHE WORK.

moved along the ways to points opposite two places on the bar ground to the same diameter, one at the outer end, and the other about the middle of the bar near one of the holes. The method of calipering, when the alinement was nearly attained, was to mark two points 180 degrees from each other on each of the two calipering places and setting the calipering points closely to the bar, then to take readings of the number of thicknesses of tissue paper interposed between the calipering points and the bar at the four points. It was always found that the center of rotation of the bar did not coincide with its center of figure, and that this was so more markedly at the outer end of the bar than in the middle. A curious thing noticed was that the rotation of figure was not coincident at the two calipering places, probably due to the fact that the cross-sections of the collars within the bearings were not truly circular. Readings taken at four points on each place and compared were very confusing. Different readings taken by rotating the calipering points generally gave no reliable information for a selection of the two sides of the bar to be used for obtaining the best results, so that but little was done in that line. The two sides were often selected haphazard and the holes brought in alinement to them. The unsatisfactory results obtained by this process led to further thought on the subject, and the following method was evolved:

Four points were marked 90 degrees apart on each of the calipering places, and at each test readings were taken from them, the number of thicknesses of tissue paper used being added together for each calipering place, and the work was considered in alinement when the total number used at the outer end was equal to the total number used at the middle of the bar. This total was frequently as great as ten or twelve.

While it is true, perhaps, that the method will not stand a strict mathematical analysis, it was simple in use and sufficiently effective in results. Of course, nowadays an indicator would be used instead of the tissue paper.

The jig partly shown in Fig. 3 was designed for the purpose of holding snap limit gages while being drilled, reamed and tapped. The box casting was 4x16x16 inches and the two faces at the corner between the gibs were scraped. There were fitted to this corner five sliding blocks drilled and bushed for guiding the tools, the reamers and taps being held at both ends. The sizes of the snap gage frames run in an arithmetical progression of one inch. Several of each size were required. The smallest size was too small to admit the two blocks inside the frame used on all the other sizes, so that a fifth block was made for that particular size. These blocks were scraped and fitted to the gibs and box casting and then drilled for the bushings. The alinement of the bushing holes in the blocks was secured as follows: The blocks having been previously numbered were placed in position in one, two, three order and lapped by means of a machinery steel bar charged with emery dust. After being lapped in this order for a few minutes the situation of the blocks with respect to each other was changed, the blocks on the outside in the previous arrangement being placed on the inside and so on. After three or four such changes, and as often as required, a larger lapping bar was put into service. The alinement improved rapidly from the start



JIG FOR HOLDING SNAP LIMIT GAGES.

and it was soon found that a bar fitting the holes separately would pass through the blocks collectively, irrespective of their arrangement on the jig.

The final result was that the ten holes

were practically of the same size, the two lines of holes were parallel with each other and each in turn was parallel with the line formed by the intersection of the two scraped surfaces on the box casting. As a matter of alinement, it was very good.

The action of a reamer known to be standard, yet which persists in cutting over size, is looked upon with more or less disfavor; but if it is a case where the reamer is slightly undersize and still reams a hole that is not only badly taper and several thousandths large in front, but which at the same time is too small at the back to permit the plug to pass through, the result is positively exasperating. The natural supposition is that there is something wrong with the floating shank, that there is not enough play, that it does not work freely, or that the arbor is too long or too heavy; and these things are considered, with varying conclusions. The smaller reamers are more addicted to this distressing habit than those of maturer dimensions. One will think that the floating shank should eliminate any small lack of alinement, and of course this is so to a certain extent. But if there is a slight bend in the arbor immediately following the reamer, the latter will seldom straighten to the hole. It is good practice to use adjustable reamers for turret lathe or similar work. It is also good practice to leave small reamers in frequent and steady use on their arbors and grind them to size in place. The arbors in such cases may be made only long enough and strong enough for the work that each reamer has to do. The best of results will follow, not only in regard to the quality of the work, but the tools are changed more quickly and their life conserved. W. E. HUNTER.

Flat Drills.

Editor American Machinist:

I read with interest Mr. Cook's remarks, page 195, and his criticism of some other subscriber's offering on flat drills. I would say that, not being a man of wide experience, and only having seen work done on this side of the water, I feel my inability to discuss things that are done in the "Old Country." However, I will ask leave to tell how I have seen flat drills made and used.

Let us take the steel that Mr. Cook has used in his figures. The way I have seen it done is to draw out the end to be used for the cutting, making it a sixteenth or an eighth of an inch wider than the drill is to be. Center both ends and turn to the required diameter, leaving a quarter of an inch or such a matter of length for smoothing the hole by scraping. This also prevents the drill from running off when it strikes a small blow-hole, besides allowing for considerable grinding without materially changing the diameter.

When you come to grind the drill and try it to determine whether the sides are ground alike, will our friend have a scrap box near or trust to luck that it does not cut large? I have seen it ground central by letting the back end rest on the center and make a scratch with the two cutting edges on any convenient piece of metal—the carriage of the lathe will do if it is not a new machine. Grind it so that both lips mark on the same line, then measure the cutting faces on each side and see that they are the same, and I think there will be no trouble about the drill not cutting central. A monkey-wrench is a fairly good thing to use for steadying the drill if you do not have a set of the irons mentioned by our Liverpool friend for that purpose.

I have seen men who were short of steel use both ends of a piece if they did not want drills to vary in size more than an eighth of an inch or so. There are men who use a flat drill on brass, bronze and several other things. It is a good idea to turn the drill over once in a while to divide up the error caused by the edges of the drill not being perfectly straight and smooth.

Another thing I would like to ask, and that is how these men who have been talking about the man who throws his back center out of line in order to turn a taper would do the job themselves if they should be confronted by the problem of turning a taper, and all the lathe they had was one without either a taper attachment or compound rest. J. O. B.

Fillets—What to Use and How to Apply Them.

Editor American Machinist:

"Patternmaker's" letter on page 342, with "Filleting Wooden Patterns" as a topic, prompts me to ask him to be a little more explicit in his writings so that we may learn that leather fillets are not only new but how to apply them so that they will stick for keeps. I see that he advocates the use of shellac or thin glue, which is at least safe advice, considering the fact that most patternmakers have not free access to the jealously guarded office mucilage bottle.

There is a well-founded tradition that George Washington, when wielding that immortal hatchet on the tree that produced the cocktail beautifiers, was only trying to earn a little pocket money by chopping out one-inch fillets for a tired patternmaker hard by who was blessed with a wholesome dread of real hard work, and one can quite believe this tale when "Patternmaker" informs us that it *is* annoying to make one's own fillets, be they made of cherry or pine.

It may be news to some of the readers of the AMERICAN MACHINIST, though I don't believe it, that fillets both wood and leather, can be made or purchased very cheaply, and any pattern shop that does not stock up on fillets of all sizes is of the kind that buys its varnish by the pint, sandpaper by the sheet, screws by the dozen, brads by the ounce, and third-class wet shelving for pattern lumber.

Wood fillets, if for use in right-angled corners, should be planed to 93 degrees angle, and are so made and sold, and if a real good job is desired, put the filleting in a fillet board and curl over the edges by sandpapering with a cylinder somewhat larger in diameter than twice the radius of the fillet. By adopting this little kink very little rubbing is necessary, provided good, stiff glue is used immediately after moistening the outer edges only, and it will be found that, when perfectly dry, the edges are there to stay and without exposing the usual irregular streaks and patches of glue at that.

As to leather fillets, there is only one way to fasten them properly, and that's with glue. After dampening the outside, not too much, and, spreading the glue as evenly as possible, get to work with your little steel ball p. d. q. until everything is lovely.

And now just a few "don'ts" on this question:

Don't saturate a leather fillet with water from the grindstone keg *before* gluing.

Don't saturate a leather fillet with water from the glue pot after gluing.

Don't slobber glue on a fillet; enough is a genteel sufficiency.

Don't ever use shellac on a fillet; it's a waste of good "booze."

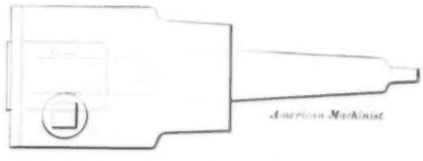
Don't ever use lead fillets with the idea that they are the ancestors of the "lead pipe cinch" family; it is not so.

OLD BOB.

Driving Drills.

Editor American Machinist:

To prevent drills from slipping when held in the patent drill chucks—different makes—just slot the end of the spindle on



TO DRIVE DRILLS WITHOUT SLIP.

which the chuck is mounted, as per sketch, and then case-harden it. The slot of course will be made of a size adapted to the drills to be held. JAMES D. ANDERSON.

Unwritten Instructions.

Editor American Machinist:

We are all of us familiar with the man who does things wrong and then finds an excuse in his instructions. In the absence of written records the blame is thus transferred to the foreman. A fellow of this order was told to prepare a pattern for the foundry, and to attach a bracket to the left-hand side. The castings—large columns—proved to be wrong, and

the foreman started for the pattern shop to fix the blame. This is how he did it: "Bill," said he, "you know that column pattern I told you to make up with the bracket on the right-hand side?"

"No you didn't," said Bill, suspecting something wrong; "you told me to put it on the left-hand side, I'm dead sure."

"Well, why in blazes didn't you do what I told you, then? You did it just the other way!" S. H. BUNNELL.

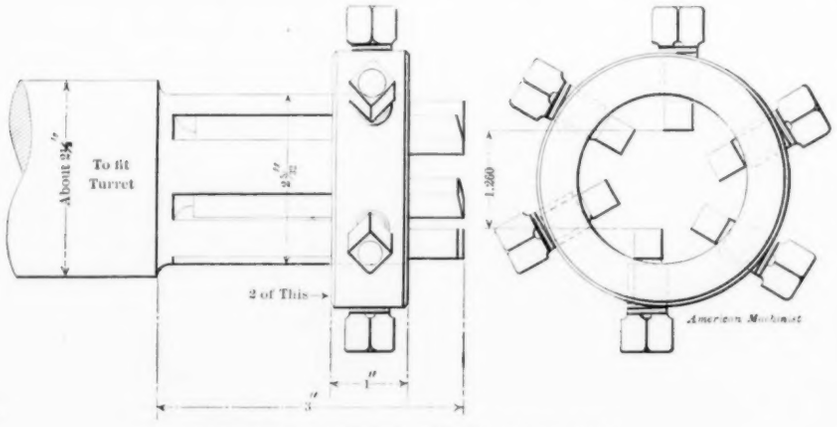
Lorain, Ohio.

A Hollow Mill with Inserted Cutters.

Editor American Machinist:

The hollow mill here shown (half size) was designed as an economizer of metal and of toolmakers' time. Our hobby here is to do away with specially machined tools as far as possible and to substitute for them Mushet steel in special holders which do not have to be renewed. We also thereby save a quantity of steel which would otherwise have to be scrapped as soon as the business end of the tool had been ground or worn out.

This mill finishes a projection about three-quarters of an inch long to a certain diameter. It consists of a straight, round piece of machine steel having in it six grooves growing deeper toward the front end of the piece, two machine-steel rings in each of which are six set-screws, and six pieces of Mushet steel about 3¼ inches in length. The grooves in the holder are cut with such a slant as to make the mill cut the proper size when the ends of the cutters project about ¾ inch from the end of the holder. This size may be made larger or smaller by withdrawing or advancing the cutters, and also by springing by means of the set-screws in the outer ring. The tools clear



ADJUSTABLE INSERTED TOOTH HOLLOW MILL.

themselves by reason of the angle on which they are placed, and as they can be taken out for grinding the operator has little trouble in maintaining a good cutting edge. The tools are set to an even length by bringing them against a surface perpendicular to the axis of the holder. We have found this to be a very satisfactory tool. ROGER HAINES.

Workmen's Critics.

Editor American Machinist:

Not very long ago Mr. Tecumseh Swift told us something about some workingmen's homes. I firmly believe that his words were beneficial. Many men saving towards a neat and comfortable home had their ambitions regenerated and strengthened, and undoubtedly others were inspired with an ambition to possess a residence like one of those shown. On this hopeful scene of future comfort and ease comes an iconoclast, a well-paid professional man, Judge Simeon E. Baldwin, of the Connecticut Supreme Court. In a speech before the Hartford Workingmen's Club he said, in part:

"There are too many lace curtains in workingmen's homes. The American workingman is intemperate about his eating as well as his drinking. He eats twice as much meat as the English workingman, and more fruit. Nobody ought to eat more than two heavy meals a day. The whole American nation is spending too much in eating and in furnishing the home. Although the nation is much richer, people are not saving as much in proportion to income as fifty years ago. A single man earning $1.50 a day should save $1.50 a week, and should not get married until he has $100 in the bank. The workingman has the better of the capitalist, in that many of the corporations have nothing left after paying wages, rent, interest and taxes. The workingmen in these factories can always get their wages, for the courts protect them even if the factories fail. There is too much spending and not enough saving among business men and workingmen alike."

All these statements converge to one point: A man should save and not spend, all his life. If so, what is to be done with the savings? True, it can be given to someone who never will deserve it, or to a spendthrift relative, or the courts can eat it up in litigation. Would it not be far better to pursue a life of comfort and contentment, spending our surplus earnings on pleasant homes, lace curtains, good meat and fruit, making ourselves better workmen at our trades, better men in intellectual, social and home life, improving future generations by bettering ourselves. "As we journey thro' life, let us live by the way." We can do this, it is natural; we can do it and still have an emergency fund.

"The nation is richer than it was fifty years ago." Certainly. What makes a nation prosperous as well as rich, the judicious spending and employment or the avaricious hoarding of the individual earnings? What would happen to thousands of men and to one great industry if we were all to save a few pennies daily and deny ourselves an insignificant luxury, the use of tobacco? Of what material benefit to the nation and the world are the millions of gold that are hoarded by individuals in India?

Pity the poor, ill-managed corporations that have nothing left after paying wages, taxes, etc., but be impartial in your compassion, and pity also the misguided workman who has nothing left after paying rent, the butcher, the grocer and the rest.

A man who says that the American workmen live too well is sorely in need of a good stiff job. Let him arise from a feathered couch at 5.30 A. M., dig for breakfast of coffee and a "stack of bucks," walk half a mile to the cars, ride 30 or 40 minutes, hanging to a strap or standing on the platform in the rain or snow, get into his overalls at 7 and push a file or work up a big bunch of nice, sharp-cornered, gritty and hefty castings until 12, eat a few sandwiches or get a "business lunch" at the corner, have a few puffs at a sweet corn-cob pipe, put in five hours more and when his day's work is over try an ordinary workingman's meal. Do this for one week, or one year, or a lifetime, my friend, then make another speech. You can gamble that it will be criticised by a professional man, who calls court to order at 10 A. M., takes two hours for lunch and adjourns at 3 P. M., whose exercise is all mental, who cannot work after a heavy meal because it dulls the brain. A workman needs a heavy meal to make up for his muscular exertions, a professional man needs only enough to sustain life. If he is gifted with a good constitution and an appetite, he soon grows quite obese. A place for each, and each in his place, gives mutual satisfaction. Each contributes his share of the world's work and neither of them should try to detract from the other's credit; there's honor enough for all.

Mr. Taylor's letter on the reliability of workmen is a sermon that I have often longed to hear and it is worth a bank note to one to see it printed in the AMERICAN MACHINIST. There are many foremen and "supers" who would be immensely benefited by a perusal of those few well-directed words. WM. H. BROOKS.

East Pittsburgh, Pa.

Living for Efficiency.

Editor American Machinist:

We cannot discuss manufacturing efficiencies with any completeness by discussing machine efficiencies alone. I have an idea that workman efficiency or operator efficiency is quite as important and quite as potent a factor in ultimate results as that of any machine. In these little letters of mine I talk sometimes very far away from the setting of work in a machine or from the actual making of chips, the finishing of surfaces or the assembling of machines, but when I am furthest from these details I still claim to be showing the chariot of progress.

The differences in men or producers are in these days greater than the differences in machines. I know where there are a score of lathes grouped together of about the same size and employed on the same line of work. As the lathes are of three or four different makes they are not just alike in feeds or speeds or stiffness or handiness, but still I need not say that there is more difference in the score of men running the lathes than in the lathes themselves. The differences in the men are to some extent due to heredity, but still more to the circumstances of their youth, to their education and to their present conditions and modes of life.

FIG. 1. GRAND AVENUE.

FIG. 2. THE BEGINNING OF A HOUSE.

I believe in the necessity of securing the best possible surroundings for American workmen. In August of last year I showed in the columns of the AMERICAN MACHINIST some of the better class of homes which workmen have been able to secure for themselves. These homes were in no respect too good for those who owned them, and if all workmen had homes as good we would have better workmen than we have, and the workmen would have more remunerative employment than at present and a still better prospect for the future.

FIG. 3. FINISHING A HOUSE.

FIG. 4. A SUNDAY DINNER.

There are no worse would-be directors of the workers of to-day than those who would narrow their home lives and restrict their outlook on the future. The constant dinging into the wage earner to save money at all hazards may be well meant, but it is nonsense. What is a savings bank, anyway? It's where you put your money to lie almost inert as far as you are concerned, but where someone else can hire it to make advantageous use of it. Why then could not you, the original owner or maker of it, make such advantageous to use it?

A learned judge has been letting himself out on this general subject and that has given me the impetus to talk about it. Listen to Justice Simeon Eben Baldwin, LL.D., of the Supreme Court of the State of Connecticut, Professor of Constitutional Law and of Private International Law in Yale University:

"The average American workingman eats too much and dresses too well, furnishes his home too lavishly and in general spends a great deal more money than he ought to. The reason for that state of affairs is the universal desire on the part of all to be as well dressed, to live in as good style and be as comfortably and showily housed as the best of one's neighbors."

The judge goes into detail: "For instance, I wonder how many workingmen there are in any city earning $2 a day who have two pairs of lace curtains in their front windows? By as many thousands as there are such cases are they too many. The man with a family and a small income better stay clear of them and the wives will be happier in the long run as well." The judge has some good advice about saving money for a purpose, and then of using it in securing a home, and I have no quarrel with him about that, although, as I have said elsewhere, I have known men who have thrown away the opportunities of their lives by becoming the slaves of the house-building idea. But when the judge goes into details about what workmen shall eat, how they shall dress, and whether they shall have lace curtains or not, he does not know what he is talking about. Let him go into the machine shop, the foundry, the blacksmith shop or any of the other shops, and he will find that lace curtains and good clothing and generous food go with good workmanship, and not only with good workmanship, but with good citizenship. Respectability is an important industrial factor. It represents both the best producers and the best or most demanding customers, and we need both. If all our workers would go right directly opposite to the directions of the learned judge, and instead of fooling away so much of their money, as we must acknowledge that many of them do, though not in the manner suggested by the judge, if they would take care to *use* their money by getting the most and the best for every dollar of it we would have no occasion to think for a moment about foreign markets except as a means of exchanging our good things for those which the suns of other climes develop better than our own.

I offer here in evidence three or four snap-shots which it seems to me have a distinct and heavy bearing on this case. These snap-shots were taken about four or five miles from Central Park in New York city. They tell their own story quite completely. Here is a settlement of Italians that have good stuff in them and who in three generations are going to make excellent citizens of the United States, but just now they don't know any better than to just follow the judge's advice. They believe in living cheap. They don't have meat probably more than once a day. These pictures were taken on Sunday noon, and they were some of them having their dinner. They had a big mess of stewed meat that I would have been glad to have tasted, and they had beer, although they are not any of them in the habit of taking too much. They don't over dress and they don't have lace curtains to their windows. They in fact don't have any windows, but they do save money, and that of course, as our judge evidently believes, is the supreme virtue. These men by some arrangement have the undisturbed occupancy of a piece of unimproved land. Here they put up their shanties and are constantly adding to them. They sleep and eat and live here when not at their daily employment, doing their own cooking and washing. They are not unmindful of the laws of health and they have no disturbances. They should be in most respects an ideal community, according to the judge's way, but compare these snap-shots with the pictures of the beautiful homes which I showed last August up in St. Johnsbury, Vermont, or the similar homes to be found in all directions in our fortunate land, and we must hope that these Italians will learn the better way and that the learned judge's suggestions will not prevail.

These fellows are living in the best way known to them, and they are not to be laughed at, but to be respected for their industry and enterprise. Their way of living, however, shows them to be far behind our American standard. The way of living is here an evidence of the general knowledge of the men. They are undeveloped mentally. I saw not the slightest sign of a book or even of a newspaper in the entire settlement. When it comes to doing any work above the crudest manual labor they are not in it. They would probably work for one-half the wages of the men of the Fairbanks Scale Works, but they could not do one-half nor one-quarter as much of the simplest of the work done there, and much of it would be impossible to them. Tell the Messrs. Fairbanks that they can have lots of men at one-half the wages they are paying and they will laugh at you when you tell them who the men are. They want, they in fact must have, men of the boiled-shirt habit, men with books and technical journals in their houses, lace curtains at the windows, a piano in the corner and what these things imply. It is because the American workman earns more than others, and then judiciously uses his earnings, or most of them, that he is the alert and prolific producer of the world. Let him save money by narrowing his life and his proficiency must inevitably diminish, and his wages will go down to the common level of the world.

TECUMSEH SWIFT.

Gang Bosses.*

BY WM. LODGE.

In speaking of the subject of "Gang Bosses," it is necessary, in order that a fair understanding may be had of the subject, to give some idea of the general get-up of a manufacturing machine shop establishment, and the ideas generally advanced in this little talk would not apply so well to jobbing establishments or establishments where a very large variety of work is done, as the manufacturing idea is very difficult to carry out in such establishments; but where work is of such a nature that duplication may be taken advantage of, I think you will readily see the wisdom of some of the points I aim to advance.

The ideal manufacturing establishment is one in which duplication is carried on to such an extent and work is made in such quantities that it will pay to expend a sufficient amount of money for a special machine for each individual operation, if such special machine would permit a sufficient amount of saving to justify its cost. Ordinarily, this would be carrying manufacturing to a point away beyond what is possible in any establishment, except those in which typewriters, sewing machines and agricultural machinery are made. There is no reason whatever why the same idea may not be applied to the manufacture of machine tools, etc., except that it would require an amount of enlargement of plant, an enormou addition to the capital and a market of sufficient magnitude to receive the stream of machines that would be made, just as the market receives sewing machines. These conditions are, of course, hard to obtain and the best that can be done is to approximate as nearly as possible to what we know to be the ideal set of conditions.

It is exceedingly difficult in any establishment gotten up on the capitalization plan to find men who will take a sufficient amount of interest; first, to decide upon just the management that will bring it out successfully; next, to be willing to buckle on the harness and get down to the kind of hard work that such a situation requires.

Let us suppose some establishment in need of such a man and being unable to find him in their own works they advertise or answer the advertisement of some man looking for such a position. After the preliminary talk has been had, the party who wishes to engage the new superintendent is impressed with the idea that he has gotten the right man, and forthwith hopes to unload his responsibility on to the shoulders of an utter stranger, in many cases a man who has not been engaged in the same line of business. I predict that, in every case, this will result in a bitter disappointment and for the following reasons:

The party who has been running the establishment, having been with it perhaps from the beginning of its existence, has naturally picked up the detail from day to day, month to month, year to year, and so gradually that he carries an enormous load with a reasonable amount of ease, while the new man, without having the advantage of years to acquire the knowledge of this particular business and pick up the little items which are so necessary for the manager to know, finds himself loaded with so much work for each day that he would surely break down under it if he attempted to carry it through,

*Prepared for reading at the Cincinnati meeting of the Metal Trades Association, but not read.

and I have no doubt a great many of you have seen such experiences. Consequently the natural result is failure, even allowing that the man had extraordinary ability.

If we had two hundred tons of merchandise to be hauled and had only one horse to haul it, we would hardly expect to make one load of the two hundred tons, but would divide it up and let the one horse take one ton at a time. It is just as necessary in loading a man with mental responsibility to divide the load as it is with a load of merchandise, and nine tenths of the superintendents who accept positions of this kind fail, because they are expected to carry the two hundred tons instead of the one ton only. Unfortunately, neither the man that engaged him nor the superintendent himself knows that this is the real fault, and yet this same fact holds good with a foreman engaged to take care of twenty to fifty men, just as clearly as it does with a superintedent who has all the men as well as all the foremen to take care of.

Being a practical man, I call to mind certain experiences of my younger days that impressed this upon my mind very clearly. During those days there were certain times when piece work was called for and in my first experience with this I had the privilege of using two or three lathes if I cared to and had in charge about five others on which other operatives were employed. Being ambitious and desirous of making a good showing, I tried to run two lathes but soon found that both were suffering, both in the feeds and speeds and also in the attention required and very often both would be stopped while mandrels, reamers, drawings, tools, etc., were being looked after. I found that by using the little intervals of time between starting and stopping a cut on one machine that these intervals could be used to the best possible advantage in looking up the drawings, tools, etc., and more work produced in a given time than if an attempt was made to run two machines. Further, in endeavoring to keep the other five operatives at work I soon found that my attention was so much taken from the regular line of work in order to see that the various operatives had a clear understanding of their work and also that their machines were stopped while they were looking up the mandrels, reamers, drawings, tools, etc., that I decided to try the experiment of not attempting to do any work but to endeavor to accelerate the work done by each one of the five other lathes and to get from each one as nearly as possible the quota of work that I myself could turn out. I found this not only successful, but very much easier for all concerned and that the five machines were kept going thoroughly well and that the product from them was increased to such an extent as to more than make up for the little amount that could have been done by myself in addition to looking after the work. This gives an idea of the gang boss.

If the conditions surrounding the work can be made agreeable, a gang boss, by reason of his closer affiliation with the men, can act and talk with a freedom that the foremen would find impossible. He can infuse a pirit that would be impossible for a foreman unless he is a man of very special ability.

Each man is fully on his metal, and as each should be a competent workman, it results in a continual endeavor of the poorest to reach the value of the best, and if any deadwood exists, means are readily taken to exchange it for another workman better qualified for the work in hand.

It is not to be expected, however, that this system can be inaugurated to-day and be working in the loveliest manner to-morrow. Like all organizations, it requires some time and a good deal of patience, as well as considerable tact and a knowledge of human nature and of how to take advantage of its little peculiarities.

If the foreman or manager lacks these qualifications, the system of gang bosses would then not be nearly as successful, nor would such good results be obtained.

The average machine shop operative usually lacks the necessary foresight to study or even to know anything of cause and effect. By this I mean that being shown a piece of vise work required to be fitted in a certain manner, his ideas do not go beyond to the point of what is the intention of this piece of work, what it is to do, what it is expected to perform, and thus a fit is made a thousandth too tight of a thousandth too free, either of which may spoil the job. Someone must supply this defect in the make-up of the operative, and while a man may be able to do it for a limited number, when it comes to a large number, it is impossible for one man to teach each and every one the function of the piece being fitted and its requirements. If the distribution of supervision is carried to a sufficiently small number of units, it will give much better results and will be less costly both in the work and in the number of spoiled pieces.

I think it might be well to express it in this way: Given a shop employing, say, 500 men, and a competent manager being needed to operate said shop, the owners should be able to see within a short time that if said manager is unable to properly handle 500 men, then the work should be distributed and two men should be given 250 each. If this is not successful, divide by four or five, or even by ten or twenty, if there comes a necessity for it. Of course, in making such a division, they need not all be men of the first grade. We no doubt all know the impossibility of getting such men. Again, it very frequently happens that men are engaged as managers of manufacturing establishments whose education has been largely technical, or business or drawing-room experience, and who because of never having absolutely measured themselves on the lathe, planer or vise against the best workman in the shop, are utterly unable to judge as to their capabilities for the different positions in which they are placed. It is the same as if a man of this kind with all the technical knowledge possible, were set to supervise a number of lathes and be expected to get the best results from them.

The technical man while going through his technical experience has been allowed, of course, to take a piece of work, mount it into the lathe, bore it, face it, put it on to a mandrel, turn it to size and length, and has probably consumed five hours in doing so, and were he to attempt the same piece again in his new position, the chances are it would be with the same results; but the apprentice boy who has worked in the department this man is to supervise would take that same piece and, instead of consuming five hours, would lay it down, a finished piece of work and a first-class job, in possibly fifteen minutes. It seems, therefore, utterly wrong to put as a supervisor over a boy, a man possessing so little knowledge of the actual doing of the work, and yet this is being done continually, and with a consequent great disappointment.

I could occupy your time quite a little in describing some of the men who have presented themselves as managers, willing to accept big salaries, and then shown their utter and entire inability to earn even one-fourth such salaries as compared with the men whom they were engaged to supervise.

If now our industrial establishments are reorganized on the plan of gang bosses, each taking care of three to ten or fifteen men, according to the nature of the work, we bring forward men who are capable of finally supervising larger numbers. Of course, many of those will be tried and found wanting, but the shrewd proprietor will, with care, be able to select from among them, men who can advance his interests far better than can be done by attempting to use men as supervisors who have not had the actual practical experience, and the men selected will be able to do not only as good work but as much of it as the best machinist employed on such work.

Had I the time I could of course elaborate on the various departments necessary to make up a successful institution, such as the drawing-room, pattern-room, tool-room, lathe-room, planer-room, vise-room; the necessity for the proper handling of the work as well as the proper handling of the men; the installation of suitable industrial railways; the avoidance of spoiled and wasted work; the attention necessary even to the item of casting-cleaning and moving of the work from one department to another; the general cleanliness of an establishment and its results; but I have no doubt you are thoroughly well tired of the subject by this time.

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The office of the AMERICAN MACHINIST has been removed from 218 William street to the World Building, Park Row.

Child Labor in New Jersey.

That is a sickening state of affairs which has been revealed as existing in the southern part of New Jersey among the glass works, in which it seems that children of tender age have been employed from seventeen to eighteen hours a day with but very few minutes for rest, and at a rate of pay which is simply pitiful. One of the glass-blowers who testified in the matter said: It is a natural result of employing boys to do men's work." Said he, "If you have boys to do men's work, then you must have babies to do the boys' work." It was shown in the testimony that factory inspectors have been very lax in their methods, and that one of the favorite ways of working the game was for the factory inspector to call at the office, remain there from a half to three quarters of an hour, during which period all the babies in the works were sent out to play, and consequently did not appear when the inspector went through. It is claimed that they were uniformly "docked" for this lost time. In many of these factories, also, it is stated that the company store system, which has been prohibited by law, flourishes and that workmen usually have little left after their accounts are settled at these stores, in which prices are from 5 to 10 per cent. higher than the highest to be found elsewhere. The Governor of New Jersey seems to be thoroughly aroused in this matter, and probably something will be done about it. Public sentiment is generally very strong against such a condition. Child labor is a crime, and its consequences both to the individual and to society are as bad as can be. It should be suppressed, and apparently the only way of doing that under present conditions is by a rigid enforcement of a strict law.

Some of America's Advantages.

It is reported that since Prince Henry's return to Germany his royal brother is making a special study of the reasons for America's rapid advance in manufacturing supremacy.

This being the case, we commend to the Kaiser the story of a German-born American citizen, who some years ago, after having had considerable experience in positions of responsibility connected with manufacturing establishments in this country was transferred to Berlin and resided there several years in charge of a manufacturing and engineering enterprise. Finally, however, an opportunity presented itself for his return to this country, and he gladly embraced it and expressed himself as being delighted to be able to return, his chief reason for this being, as he expressed it, that he was patronized in Germany by the army and navy officers with whom he came in contact in a business way, they assuming a superiority over him simply because he bore no military title. Now, as a matter of fact, this man is one whom any country may be proud to claim as a citizen; an able engineer and business man, thoroughly trained and of exceptional capacity for good work. It has seemed to many of those who have studied the difference between conditions here and in Germany that men of his type are in Germany generally absorbed by the army and navy, or that if, for any reason, they do not go into the military service they are likely to migrate, many of them coming to America, where they contribute their full share to the advancement of America in manufacturing enterprises. It is believed by those who have given the matter most attention that the reason why America advances so rapidly is because there is here a greater degree of individual liberty than is to be found anywhere else. It is our belief that religious, political and civic liberty is the chief stimulus of advance in the arts of manufacturing as well as other advancement and that in proportion as such liberty is curtailed development of manufacturing and of business will be retarded, other things being equal.

Adulteration of Food Products.

In the State of Connecticut they have been making some investigation recently of the subject of food adulteration with results that are somewhat startling. There is a general impression that prepared food products are very commonly and very much adulterated in this country, but there is little definite information about it, at least among the people generally. According to a press dispatch, however, the Connecticut authorities have found the following facts regarding food sold in that State.

Out of 375 samples of milk secured in 28 towns of the State, 8 per cent. were found adulterated. One-tenth of the samples of coffee were found adulterated; 18 out of 38 samples of jelly; 19 out of 29 samples of cordials; 41 out of 62 samples of vanilla extract; 51 out of 66 samples of lemon extract; and extensive adulteration of many kinds of spices, chiefly by ground cocoanut-shells. Out of 1,256 samples of food products analyzed, 441 were found adulterated, 29 of them with preservatives only. Eighteen out of 35 samples of suspected butter contained oleomargarine, and 25 out of 231 samples of molasses contained glucose syrup.

It is our belief that the most stringent laws should be made and enforced against food adulteration. It is a subject in which workingmen are particularly interested. They are usually compelled to carefully consider the expenditure of every dollar and dime, and the temptation is naturally strong to buy those goods which are offered at the lower price, where no means are at hand for arriving at a definite conclusion as to which is the better of two

articles offered. No one but an expert can detect adulteration in food products, and it is a case in which the State should step in to protect its citizens from imposition and injury. The question also has an important bearing upon the question of the cost of living as compared with former times. The general impression is, and we have no doubt, that adulteration is now much more common than in former years; and if this is so, it would be interesting to know the ratio existing between adulteration and decline of prices in various food products. Almost any old housekeeper will tell you that foods, generally, seem to be much more adulterated than formerly. And the same is true of textile fabrics, many of which that now go by the same names they bore twenty-five, thirty or forty years ago, and are sold at one-half to one-quarter the price being at least proportionately inferior to the goods sold in the old times. It is an illustration of the fact that statistics are not reliable, unless you understand the basis of the statistics and all about the circumstances under which they are collected and collated.

A significant move concerning the United States Steel Corporation has been taken by the Deering Harvester Company, of Chicago, which is said to be behind a plan involving the expenditure of three million dollars in the erection of steel mills in South Chicago, which will employ two thousand men. The new company has secured its own iron mines in the Mesaba range near Hibbing, Minn., so that it will be on a practically even basis with the United States Steel Company in this respect as well.

The rather unusual spectacle of a member of the British nobility testifying before a Congressional Committee at Washington was seen the other day when Lord Kelvin, the scientist, appeared before the Committee on Coinage, Weights and Measures, and testified in favor of the adoption of the metric system. He said he had long hoped that England would adopt the system, but that if his own country would not do so, then he thought the United States should lead off and believed that England would soon follow.

It is reported from Berlin that Emperor William has deeply offended many of the German nobles by having recently entertained on an excursion in the North Sea aboard the "Kronprintz Wilhelm" certain merchants and manufacturers of Germany. It is believed that it was the Emperor's intention to favor these men and to let them know that he favored their social elevation; but, as might be expected, the conservative journals of Berlin are lamenting and scolding about this and saying that it means a revolution in Germany's ways and customs, and one which will be disastrous to the country. Among the men entertained by the Emperor, Herr Loewe is mentioned.

Somewhat of a novelty in train service has been inaugurated by what is known as the Bound Brook Route between New York and Philadelphia, which is operated by a combination of the Central Railroad of New Jersey and the Reading Railroad. These roads will run trains between New York and Philadelphia at every even hour from seven o'clock in the morning until six in the evening, a train leaving each terminus on the even hour every week day. The trains are fast expresses, will usually make the run of 90 miles in two hours, and the roads have been improved and special rolling stock procured for the service.

The establishment of a post graduate course in steam engineering at the Naval Academy at Annapolis will occur next fall. Rear Admiral Melville, Engineer in Chief, has earnestly advocated that this be done. The project has met with the approval of Rear Admiral Crowninshield and Rear Admiral Taylor, and of Commander Wainwright, Superintendent of the Naval Academy. The course will be for young officers, and will enable their improvement in steam science. No additional expense will be incurred by the establishment of the course. Rear Admiral Melville proposes that a laboratory for scientific research shall be located at Annapolis, and is strongly urging Congress to make an appropriation of $400,000 for the building and apparatus.

Reports that reach us regarding what goes on within the Russian Empire are notoriously untrustworthy, but a report which appears to be at least as credible as any we receive from that section of the world, states that there is considerable industrial disturbance in Russia at present, the centers of which appear to be St. Petersburg and Moscow. There is a movement among workingmen for a ten-hour day and coupled with this seems to be opposition to foreigners, especially those who are employed as foreman or superintendents in industrial establishments. According to this report, the expression used by the Boxers of China, "Foreign devils," is frequently heard upon the streets there, and it seems possible that there is a sentiment against the Germans, English and Americans in Russia, which may have an important influence upon the industrial development of that country; very many men of these nationalities being in positions of responsibility in Russian establishments.

According to a press dispatch, at a recent annual meeting of the shareholders of Ludwig Loewe & Co., of Berlin, the directors were criticised by certain stockholders for their extravagant policy to which the complainants attributed the reduction of the company's dividend for this year to 12 per cent., the previous rates of dividend having been 24 per cent. for the past five years. Replying to this criticism the chairman of the company said it had been found necessary to arrange for meeting the competition of the American tool builders, who had demonstrated that they could sell tools in Germany at a lower price than the cost of production in Berlin. The result had been an investigation of conditions, and the conclusion that it was necessary to erect a modern and thoroughly well equipped plant for the production of such tools, and to equip it with the best American machine tools and operate it largely by American methods, including the American social labor conditions, namely, high wages, comfortable and well-lighted buildings, and the hardest work consistent with health.

Elsewhere in this issue we publish a paper by Mr. William Lodge, of Cincinnati, in which he sets forth some of his views regarding shop management. These are interesting as coming from a man who has had a wide experience in workshops both in Great Britain and in America and who is in the habit of closely observing things pertaining to manufacturing operations. His views differ radically from those held by some other shop managers particularly with regard to the qualifications desirable in a foreman or "gang boss." There are those who think that a foreman, superintendent or a "gang boss" needs no practical knowledge of the work which he directs, and many arguments have been adduced to show this and to maintain that if one only has that mysterious and undefinable quality known as "executive ability" a knowledge of the business is of no importance. Mr. Lodge, it will be noticed, takes sharp issue with this point and insists upon the importance of a foreman thoroughly knowing the technical operations with which his work deals.

Lord Kelvin's Reception at Columbia University.

The reception given to Lord and Lady Kelvin at Columbia University on the evening of April 21 by the officers of the university and of the most prominent scientific societies was an honor that could not well have been more worthily bestowed, Lord Kelvin being in the very front of living scientists and having a long and brilliant record of achievements in the advancement of modern science. The exercises were conducted by Dr. F. B. Crocker, past president of the Institute of Electrical Engineers, and addresses eulogistic of the guest of the evening were made by President Butler, of Columbia University; Prof. Elihu Thompson, Dr. Gordon Web-

ster and Dr. Robert Simpson Woodward. The speakers dwelt most upon the services of Lord Kelvin in connection with the Atlantic cable, although his multitudinous other works were also indicated. As Lord Kelvin came forward to speak his acknowledgments it was not easy to repress the exclamation, "poor old man," for it must be acknowledged that he shows the burden of years; nevertheless he made a speech of considerable length which was highly appreciated and applauded. He said that the meeting was not only one of welcome to a citizen of another country, but it was a union of the sciences and to scientific men must be memorable. The first time that he landed on this continent was in 1866; ten years later he came to the Centennial Exposition; in 1884 he came again, noting the great achievements in science which were so rapidly succeeding each other, the last time being most notable by the successful inventions of Edison. Mr. Edison, who was present, was compelled to rise in acknowledgment of the prolonged applause of the vast audience. Lord Kelvin spoke finally of the utilization of the power of Niagara with the hope that it might yet be made to do vastly more for American industries. After the speaking a large portion of the audience crossed the platform and shook hands with the guest of the evening and his wife.

Drinking Water for Workmen.

We receive inquiries from time to time as to our experience in furnishing prepared drinking water to our workmen during the hot weather, especially those employed in our forging, foundry and other departments where there is intense heat. We take stone jars or kegs holding about 10 gallons of water filled with water and a small quantity of ice, pack the jar in a barrel with sawdust between the inner and outer vessels. Thus the water is kept cool with a minimum amount of ice. Each morning we place about ½ pint of oatmeal, rolled oats, Quaker oats, or any other form of crushed oats in the water. This crushed oats thus used makes the water a remarkable thirst quencher. During the several years that we have thus provided drinking water we cannot recall a case of heat prostration or illness due to excessive drinking of water by men employed in our shops where the heat is great. We also find that this water reduces the appetite for intoxicating drinks, and in general the effects are so excellent that our men are telling it to workmen in other shops and cities. The jar should be emptied and thoroughly cleansed every morning, as the oatmeal sours over night, and of course the drinking cup also ought to be scalded and scoured for obvious reasons each day. We would be glad if the water could be drawn from a spigot, as of course from a sanitary view the use of a dipper in the top of the jar is not as it should be, but the oatmeal clogs the spigot or strainer leading to a spigot. It has contributed not only to the comfort of the men, but has permitted them to continue at work when the heat might otherwise have prevented, and has greatly reduced the temptation of the men to seek intoxicating cooling drinks. For a few days the oatmeal flavor may not be relished by all of the men, but very soon they find it palatable and are delighted by the relief afforded.

B. F. Avery & Sons.

Louisville, Ky.

Insurance Engineering.

Under the leadership of Edward Atkinson, of Boston, president of the Boston Manufacturers' Mutual Fire Insurance Company, an experiment station is likely to be erected for the purpose of making all sorts of tests of fireproof materials and fire-resisting constructions.

There should be, Mr. Atkinson says, a building of very solid construction of fire brick, corresponding to a bay in a factory, say 20 feet long by 10 feet wide by 10 to 11 feet high, on which the makers of so-called fireproof floors may place examples of their work to be subjected to a very high temperature and to very heavy loads. There must be apparatus for lifting and placing these loads, for measuring the stress and deflection. There should also be doorways and window spaces at which to test fire doors, glazed windows, and other devices, and a small, effective producer gas plant, it having been found extremely difficult to reach and maintain the very high temperatures often developed in an actual fire at the melting point of cast iron, with the ordinary materials, cordwood and the like, with which our own tests have been made. There must be hydrants and apparatus for extinguishing fires, and other apparatus necessary to the completion of these tests.

This station may form a part of a "School of Insurance Engineering," which may be connected with the Massachusetts Institute of Technology.

Labor Situation in Chicago Shops.

Officials of the International Association of Machinists and some manufacturers in Chicago anticipate that the labor troubles in the shops in this city this spring will not be serious. For eleven months strikes have been officially in existence in the following five shops: Allis-Chalmers Company (Frazer & Chalmers and Gates Iron Works), Robert Tarrant, Chicago Shipbuilding Company, H. H. Scoville Company and G. L. Thompson Company, and these continue, though the shops are operated by non-union men. No demand was made by the machinists upon the manufacturers of Chicago this spring up to Monday this week, but one is expected in a few days. It is reported that the men will ask for a straight nine-hour day for a minimum of 30 cents per hour. The present minimum is 28 cents. Business Agent A. E. Ireland of District No. 8, International Association of Machinists, says that about half of the shops located directly in Chicago are now operating on a nine-hour basis and the other half on a ten-hour basis with Saturady half holiday. He says that while 28 cents is the minimum wage scale, many of the shops are paying their men 30 cents. There are about one hundred shops located in the city with a considerable number of others in suburbs of about 25 miles radius. J. B.

Chicago, April 28.

Breaking Up Old Guns.

How to break up large masses of iron for remelting is not an unfamiliar puzzle. Perhaps as difficult as any to dispose of are the large and now obsolete cast-iron guns which remain from the Civil War period. A number of 15-inch smooth bore Dahlgreens were sold at the Mare Island Navy Yard and have been broken up by the purchaser. The method adopted was to drill longitudinal rows of holes and first split the mass by wedges into sections. Gang drills were used drilling 15 one-inch holes at a time. The gun was mounted on roller bearings so that it could be rolled and 16 rows of holes were drilled. The holes were drilled to a depth of only 7 inches and about 4 inches from center to center, the wedges doing the rest. After the splitting the pieces were further reduced by drilling single holes and blasting with nitro-glycerine within a prepared barricade.

An exposition of the trades and industries of the Rhineland and Westphalia, Germany, was scheduled to open at Düsseldorf, May 1. It has been the plan to make a showing of the German mining, iron, machine shop, foundry and electrical industries, etc., which would compensate for the impossibility of doing them justice at Paris, owing to lack of space, and in spite of the depression that has overtaken business since this programme was arranged it will be fully carried out. Krupp's exhibition building is over 400 feet in length.

Personal.

Joseph O. Wilson has been appointed superintendent of the Buffalo Steam Pump Company's plant, North Tonawanda, N. Y.

We would like the name and address of the person who signs himself "Amateur" to an article on screw propeller making.

Daniel J. McNamara has retired from the Oswego Boiler Works Company, and will shortly resume his former position as superintendent with the Ames Iron Works Company.

H. R. Lasch, the machine-tool man for Selig, Sonnenthal & Co., of London, has been visiting among the machine shops of

America for some weeks past, and will sail for home on the 3d inst.

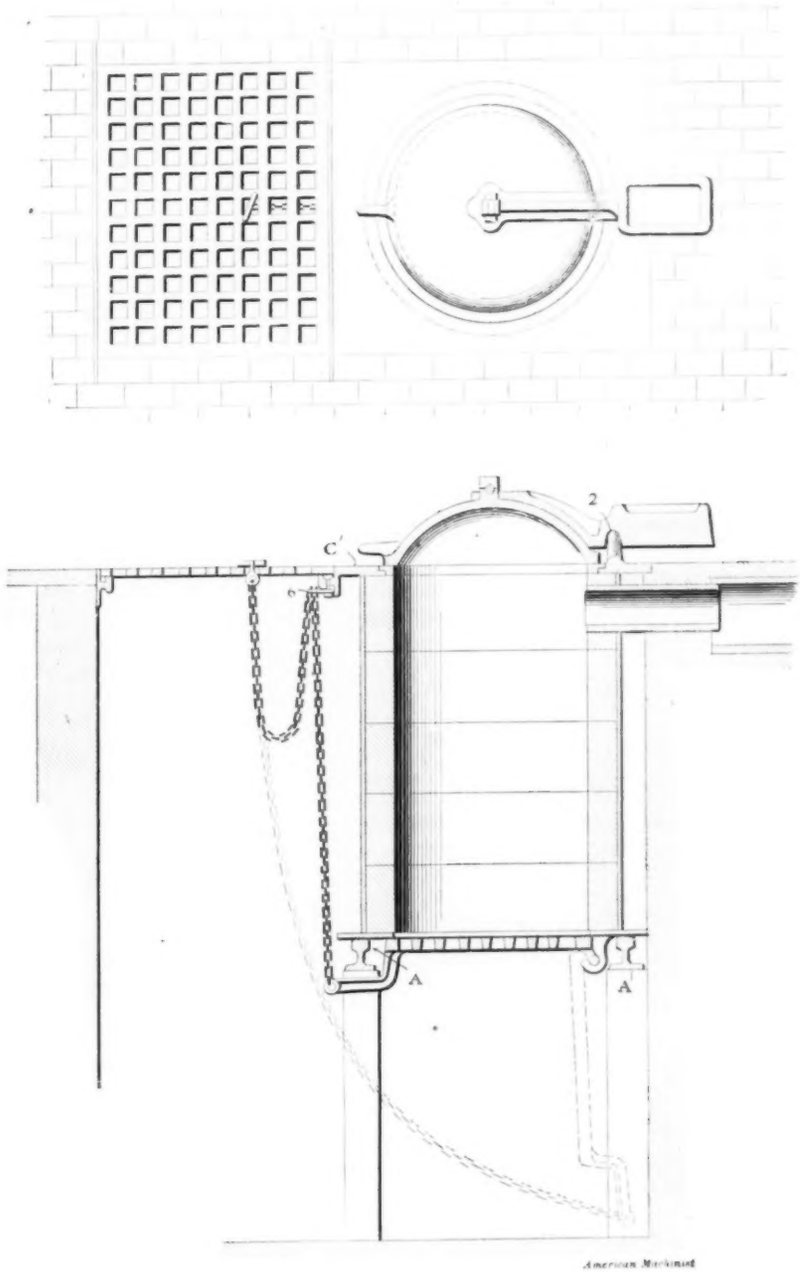
J. B. Orbison, of St. Louis, has become general manager of the Southern Foundry & Machine Works, Fredericksburg, Va., succeeding L. J. Milbourne, who will represent the establishment in Baltimore.

Wm. B. Murdock, who a short time ago became engaged with Manning, Maxwell & Moore, of this city, has resigned and will be connected with the De Laval Company, of 74 Cortlandt street, New York.

Some New Things.

IMPROVED BRASS MELTING FURNACE.

The accompanying cut, adapted from a recent United States patent, shows a brass furnace embodying some improvements. The furnace is built upon two parallel beams *A*, a suitable base-plate *a* serving to support the entire construction. The body of the furnace consists of an outer iron or steel shell with a suitable lining of fire-brick, the plate *C'* on top of these coming flush with the floor. The seating ring for the cover is separate from the top plate *C'*. The cover, very heavy, is dome shaped, with a stout pin or projection standing up in the center. At the side of the cover, integral with the top plate, is a spherical topped pin 2 on which is pivoted a balance lever, the eye of which sets over the central horn of the cover with a cross bolt above it. At the other end of the balance lever extends an arm with a counterweight sufficient to nearly balance the weight of the cover. The cover can thus be easily swung off to the side without lifting whenever the furnace is required to be uncovered.



IMPROVED BRASS MELTING FURNACE.

The grate of this furnace, it will be seen, can be operated from the floor without requiring the furnaceman to go down into the furnace pit to dump the furnace. The grate is pivoted at the back and is secured in front by a chain of the required strength, this chain being caught by a link on the catch or hook 6. Unhooking this is of course all that is required to allow the grate to drop to the position indicated by the dotted lines. The patentees of this furnace are A. J. and E. H. Weatherhead, Cleveland, O.

DOUBLE COMPRESSION COUPLING.

The coupling shown herewith is intended for line shafting from 3 to 8 inches in diameter. The body of the coupling has a taper hub, split in three places: the four

DOUBLE COMPRESSION COUPLING.

flanges shown are bored out to fit the hub. In putting the coupling on the shafting, the two inside flanges are put on the hub and drawn up tight by three bolts. Then the outside flanges are put in place and drawn on by three through bolts. Thus the hub is compressed by four flanges and has a powerful grip on the shafting. Each flange has three tapped holes, and when the coupling is being removed, the bolts can be screwed through these holes to force the flanges off the hub. The rims of the outside flanges cover the bolt heads and nuts and prevent their catching belts or clothing. This coupling is made by the W. P. Davis Machine Company, of Rochester, N. Y.

Commercial Review.

NEW YORK, April 28, 1902.

MACHINERY AND SUPPLY NOTES.

Supply dealers' reports denote a volume of season's trade which apparently surpasses any from a time whereof the memory of man runneth not to the contrary. The period has now come for a natural sagging off precedent to midsummer, and the signs of such a change may be found, although they are as often absent as present. A few weeks ago there was a pretty

strong upward tendency, and in many cases movement, of prices, but the progress of values has been checked and they are now steadier than they were, with an ample degree of firmness as relates to private transactions. One seller of much experience predicts a quiet summer, on the ground that figures are now too large, but not much complaint of that sort is heard in the class of goods most closely pertaining to machine shop uses.

There is quite a spurt of government buying for navy yard supply purposes, attributed to the stimulus of a new appropriation. Bids have recently been opened on a lot of twist drills for the Washington Navy Yard amounting to about $1,300, while nearly double that valuation has just been figured on for the Puget Sound Navy Yard. Bids will be opened this week on a lot for Norfolk, Va., and next month estimates will be received on a consignment for Mare Island, specifications for which have been issued.

The American Cycle Manufacturing Company is in the midst of the busiest season it has experienced since 1898. This line of trade is so governed by the calendar that the company is taking in outside work to keep up the pace and bridge over the usually dull summer months. The Westfield (Mass.) factory of the company has completed an addition 210x50 feet.

It is announced that Oscar W. Mueller has withdrawn from the firm of Dreses, Mueller & Co., Cincinnati, Ohio, and his interest has been acquired by the former co-partners, Henry Dreses, Wm. Gilbert and Chas. Lange. All assets and liabilities are assumed by the above partners, and the management of the firm will be as heretofore under the personal supervision of Henry Dreses. The name of the firm from the first day of May, 1902, is Dreses Machine Tool Company.

A rumor recently reached us that the Allis-Chalmers Company was proposing to enter the manufacture of steam turbines. Seeking further information in this particular, we have written them and have received the following reply: "At present we are not contemplating taking up the manufacture of steam turbines. Although we are watching progress in this class of machinery with great interest, we do not consider that enough progress has been made to warrant our taking up this branch of manufacture."

There seems to be quite a little boom in shipyard equipment operations in New York and vicinity, so that a seller of machine tools is disposed to compare it with the bicycle and automobile building manias of past years. However, the movement is yet within conservative proportions. One of the concerns which is expected to buy quite a lot of tool equipment shortly is the Standard Shipbuilding Company, of Perth Amboy, N. J. There is also an inquiry out for a large quantity of tools for boiler working purposes believed to be for installation in the New York region, but whether intended for shipyard use has not been ascertained. Machines such as lathes, punches and plate bending rolls are called for. The last named are required to take a plate 7/8 inch thick and 14 or 15 feet wide. The New York Kerosene Oil Engine Company, which recently purchased a tract of land at College Point, N. Y., has erected a factory on the premises for building launches, yachts and working boats, the propelling power being kerosene oil. The Townsend & Downey Shipbuilding Company's new plant at Shooter's Island is a matter of pretty general knowledge. The Pacific Coast has for some time seemed to have an important and not very remote shipbuilding future. It is reported from Tacoma, Wash., that the industry there continues to flourish, many new vessels being under way at the yards. A project in Halifax, N. S., we mentioned last week.

The report of the General Electric Company for the year ending January 31, 1902, has just come out. This annual pamphlet has long borne a reputation for lucidity and candor which set a precedent worthy of imitation by other large corporations, some of which while attempting to control the supply of their respective commodities for the entire public seem to think it an impertinence that the public should seek to know something about the gross output or other leading statistics of the business. The document before us shows that for the last eight fiscal years the amounts billed and orders received have been as follows:

Years Ending Jan 31st.	Amounts billed.	Orders received.
1895	$12,540,395	$12,160,119
1896	12,730,058	13,235,016
1897	12 540,994	11,170,319
1898	12,396,093	14,382,342
1899	15,679,430	17,431,327
1900	22,379,463	26,323,626
1901	28,783,275	27,960,541
1902	32,338,036	34,350,840

Since February 1, 1900, some items have been excluded from the totals of orders received which previously were embodied in those figures. The statistics given evidence the great increase in business that has taken place in the past year. In the year ending January 31, 1901, we notice that the tremendous advance made just previous had been checked. Indeed, the fact that new orders received in that year were less than old ones filled indicates that for a time there was a decrease. But the renewed upward movement since then has been most satisfactory. The orders received in the last year include: Generators and rotary converters, capacity about 350,000 kilowatts; railway motors, capacity over 600,000 horse-power; other motors, capacity over 150,000 horse-power; transformers, capacity over 200,000 kilowatts; incandescent lamps, over 15,000,000.

The Pittsburgh Gage & Supply Company, Pittsburgh, Pa., report an excellent demand for its White Star Oil Filter. A shipment of four filters was recently made to the Yarbic Mines, Japan. The company has also recently booked orders for their Continuous Oiling Systems, using the duplex types of the White Star filter, one of 6,000 gallons filtering capacity per day for the Union Steel Company, Pittsburgh, and one for the Citizens Railway, Light & Power Company, Mansfield, Ohio, supplying a Cooper tandem compound, a Bates cross-compound, and an Allis simple type engine with a continuous flow of clean oil upon all bearings.

The Westinghouse Electric & Manufacturing Company has recently sold two rotary converters of 300 kilowatts each to the Manchester (N. H.) Traction, Light & Power Company. They will be located at Hookset, N. H., and will deliver power for the operation of the Concord & Manchester branch of the Boston & Maine Railroad. The Westinghouse Company has also lately sold two rotary converters to the South Covington & Cincinnati Street Railway Company, one being of 200 kilowatts and the other of 400 kilowatts capacity. The first cement plant in Canada to be operated by electric power is that of the National Portland Cement Company at Durham, Ontario. All of the cement-making machinery in this plant will be driven by induction motors supplied with current by two Westinghouse 450-kilowatt three-phase alternators with exciters, etc.

CHICAGO MACHINERY MARKET.

The motors for its second shop were recently purchased by the Allis-Chalmers Company, the aggregate being nearly 1,000 horse-power, and the seller being the Bullock Electric Manufacturing Company, who sold the equipment for the first shop. For factory installations the trade in electrical machinery has not been quite so active during April as in earlier months this year. Two causes seem to have contributed to this partial lull. When a number of inquirers, slow to close for their shop power, have been approached in recent weeks they have responded to questions about their orders by saying that they have postponed until next year the construction of new plant, on account of the impossibility of procuring structural material, either using their old plants or leasing others temporarily, in either instance being unwilling to install expensive equipment. There has also been a feeling this month that labor troubles may crop out about May 1 and pending the outcome manufacturers have been going slow in the matter of large expenditure for shop.

But these are ephemeral circumstances, and the first one mentioned has in it the promise of much future business. While it has been a not uncommon statement for salesmen of electrical machinery to pronounce business quiet, there is almost a unanimity in describing the outlook as bright. The general expectation is that business this year in electrical machinery will surpass all records. The Chicago

office of the C & C Electric Company sold as much machinery this year to March 15 as the whole of last year up to September, and there seems little doubt the business of 1901 will be greatly surpassed this year.

The demand for central plant equipments is brisk, street railway, light and power companies being even more active buyers of electrical power than factories. The Electrical Equipment Company, organized this week with J. Holt Gates, president, and J. W. Peterson, manager, as contracting engineers, has sold a 250-kilowatt generator to Armour & Co.; a 60 horse-power generator to the Urbana Heat, Light and Power Company, Urbana, Ill., and a 200 horse-power generator to the Homewood Electrical Light and Power Company, Homewood, Ill.

The Milwaukee Electric Company has sold a complete outfit to the American Well Works, Aurora, Ill., consisting of a 125-kilowatt generator and about fifteen motors. The Northern Electrical Manufacturing Company reports a heavy inquiry and a large number of orders booked.

Roth Bros. & Co., Chicago, are doing a large business in generators and motors. Since January 1 they have almost doubled their force of men and are contemplating a further increase in shop capacity.

Quotations.

NEW YORK, Monday, April 28.

Pennsylvania Foundry Pig Iron, Jersey City delivery:

No. 1 X	$20 15 @	$20 65
No. 2 X	19 65 @	20 15
No. 2 plain	19 15 @	19 65
Gray forge	18 65 @	19 15

Alabama Pig, New York delivery:

No. 1 foundry, or soft	19 25 @	20 25
No. 2 foundry, or soft	18 75 @	19 75
No. 3 foundry	18 25 @	19 25
Foundry forge, or No. 4	17 25 @	18 25

We attempt to quote somewhere near the actual selling market. The prices of Southern irons based on $12.00 at furnace for No. 2 might still be proper as a nominal minimum quotation, though there is a rumor that a higher furnace basis is named for shipment to this market.

Bar Iron—Base sizes—Refined brands, mill price on dock, 1.93c. in carload lots. Smaller quantities from store, about 2.10c.

Tool Steel—Base sizes—Good standard quality, 7c.; extra grades, 10c. and upward.

Machinery Steel—Base sizes—From store, 2.00 @ 2.10c.

Cold Rolled Steel Shafting—Base sizes—From store, 2¾c.

Copper—Lake ingot, about 12 @ 12⅛c.; electrolytic and castings, about 11¾c.

Pig Tin—In 5- and 10-ton lots, f. o. b., New York, 28¼ @ 28½c.

Pig Lead—4.10 @ 4.12½c. in 50-ton lots.

Spelter—4.35 @ 4.40c., New York delivery.

Antimony—Cookson's, 10 @ 10¼c., according to quantity upward from one cask; Hallett's, 8c.; U. S., 8 @ 8⅜c., various brands, 7¾ @ 8c.

Lard Oil—While it is possible some may still be obtained for less, a leading brand of Prime City oil was to-day quoted at 82 @ 84c., with a further advance imminent, and there is talk of the price reaching a dollar.

Manufacturers.

A site has been purchased for the Brenham (Tex.) Cotton Mill.

The Johnson-Jennings Company, Cleveland, O., will erect a pattern shop.

The King Plow Works, Phelps, N. Y., are preparing to enlarge the plant.

Fire has considerably damaged the Woodhouse chain works, Trenton, N. J.

A boiler-house will be erected at the mill of the Oakland Worsted Company, Oakland, R. I.

The United States Thread Company, Leominster, Mass., is building an addition to its plant.

The Garlock Packing Company, Palmyra, N. Y., is making arrangements to enlarge its factory.

The works of the Crescent Gas Fixture & Art Metal Company, Bridgeton, N. J., are to be enlarged.

A power-house of the Lehigh Valley Traction Company, Allentown, Pa., will be rebuilt and enlarged.

Charles J. Prankard's Sons, manufacturers of machinery, Troy, N. Y., will erect a new machine shop.

An addition, 40x66 feet, is to be built to the machine shop of Baxter D. Whitney, Winchendon, Mass.

W. C. Downey & Co., manufacturers of bale ties, Springfield, O., have been granted a factory building permit.

Plans have been prepared for enlarging the plant of the Holmes & Edwards Silver Company, Bridgeport, Conn.

The sulphite mill of the Cumberland (Md.) Paper Company has been destroyed by fire and will probably be rebuilt.

An addition is being built to the pattern shop of the Globe Foundry & Machine shop, Morrellville, Johnstown, Pa.

The Niles Iron & Steel Roofing Company's plant will be moved to a new site at Niles, O., and extended in so doing.

The R. Wallace & Sons Manufacturing Company, silver tableware, Wallingford, Conn., is to make an addition to its plant.

The Fostoria Glass Company, Moundsville, W. Va., intends to erect an addition to be used for tumblers and stem work.

The Granite Portland Cement Company, Cleveland, O., proposes to establish a plant near Clyde, Wayne County, N. Y.

The United Shoe Machinery Company, Boston, Mass., is looking for a place where four of its plants can be merged into one.

Car barns and repair shops of the Western Ohio Electric Railway system, covering 110 miles, will be located at Wapakoneta.

The Standard Oil Company has broken ground for a new building at Dunkirk, N. Y., in the rear of which will be a power-house.

Plans are being prepared for the reconstruction of the cigar box plant of A. A. Wood, Tampa, Fla., which has been burned.

Plans have been completed for a 312x72-foot, two-story addition to the United States Playing Card Company's plant in Norwood, O.

The Puget Sound Machinery Depot at Seattle, Wash., has been granted a permit to make additions to its building, to cost $5,000.

As a result of a change in the management of the Batavia (N. Y.) Consolidated Gas & Electric Company, the plant will be enlarged.

The contract has been let for the erection of a 50x75-foot six-story building for the Baldwin Locomotive Works, Philadelphia, Pa.

Work has begun on the addition to the plant of Boll Brothers Manufacturing Company, makers of brass bedsteads, Harrisburg, Pa.

The Great Lakes Glass Company, recently incorporated in New York State with a capital of $50,000, is about to built a plant in Buffalo.

Spon & Chamberlain, publishers and importers of books on engineering, etc., are moving into quarters at 123 Liberty street, New York.

The York (Pa.) Safe & Lock Company has broken ground for an annex to the present plant, which will more than double the capacity.

Contracts have been let for the construction of the buildings of the West Virginia Bridge & Construction Company, Wheeling, W. Va.

The Warsaw-Wilkinson Company, which has established an ensilage cutter plant at Warsaw, N. Y., has decided to double its buildings already.

E. F. Durang, Philadelphia, Pa., has prepared plans for a 102x57-foot boiler and engine house on the grounds of the convent at Glen Riddle.

The Kutztown (Pa.) Foundry & Machine Company will increase its capital stock from $50,000 to $100,000. It intends to build a larger foundry.

The Saco & Pettee Machine Shops, Newton Upper Falls, Mass., and Biddeford, Me., contemplate building a large addition at one or the other place.

The Burns Steel & Metallic Company, manufacturer of crucible and sheet steel, will, it is said, locate a plant on the Piper farm, northwest of Latrobe, Pa.

It is reported from Oswego, N. Y., that plans are being prepared by the Oil Well Supply Company for the erection of a new machine shop, 400x60 feet.

The Reading Company will shortly sink two shafts at Buckville, near Tamaqua, Pa., and erect a breaker, giving employment to over 1,000 men and boys.

The Baltimore & Ohio Railway Company has purchased properties near Glenwood station. A part of the ground will be utilized for an extension of the shops.

A permit has been granted to build for Alfred Ilsinger a machine shop and boiler-house in Stenton avenue, near Wyoming street, Wayne Junction, Philadelphia.

The firm of John S. Jackson & Son, Bath, Me., manufacturers of blocks, etc., have closed the contract for rebuilding the plant, which was destroyed by fire recently.

Grading has been commenced at the plant of the Modern Steel Structural Company, Waukesha, Wis., preparatory to the erection of a new building, 160x160 feet.

The Union Bag & Paper Company, 1 Broadway, New York, is contemplating enlarging its plant on the Moreau side of the river at Sandy Hill, by erecting a sulphite mill.

It is proposed to supply a new engine and boiler plant and to increase the spinning capacity of the mill of the Barnaby Manufacturing Company, Fall River, Mass.

J. E. Tilt, the Chicago shoe manufacturer, will, it is said, erect a large factory at Lester-

shire, N. Y., the coming summer. It is claimed that the project is backed by $4,000,000.

The water department, St. Louis, Mo., will build a $40,000 blacksmith shop and a machine plant. The machine shop will be 60x130 feet, and the blacksmith shop 26x57 feet.

Ground has been broken at Perth Amboy, N. J., by the Standard Underground Cable Company, of Pittsburgh, Pa., on the $500,000 copper wire drawing plant to be erected there this year.

The plant of the S. Severance Spike Works at Glassport, Pa., is to be doubled in capacity. There will be an addition to the machine shops, and the old machines are to be replaced by new ones.

The contract has been awarded by the American Woollen Company, which owns some thirty mills throughout New England and New York State, for a new mill at Winooski, Vt.

The Hecla Iron Works, 118 North Eleventh street, and the Tuttel & Bailey Manufacturing Company, ornamental pattern maker, 79 North Tenth street, Brooklyn, N. Y., intend to enlarge their plants.

The Ackerman interests of Plainfield, N. J., which control cement plants at Cumberland, Md., and elsewhere, will erect a plant of 2,000 barrels daily capacity at Riverside, Mineral County, W. Va.

Miscellaneous Wants.

Advertisements will be inserted under this head at 25 cents a line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Gear Wheels, gear cutting. Grant ; see p. 18.

Punches & dies. Wal.M.Wks.,Waltham,Mass.

Stamping dies. Emmons Collins, Chicago.

Caliper cat. free. E. G. Smith, Columbia, Pa.

Patterns and models. 19 Thames st., N. Y.

Will buy or pay royalty for good patented machine or tool. Box 282, AMER. MACH.

Fine machine and experimental work. The Des Jardins Type Justifier Co., Hartford, Ct.

Light and fine mach'y to order ; models and elec. work specialty. E. O. Chase, Newark, N. J.

Light machine & experimental work ; models made. S. Messerer, 15 Springf. av., Newark,N.J.

F. J. Stokes Machine Co., 13th and Noble sts., Philadelphia, cut light gears, cams and duplicate small machine parts, in quantities.

Special and automatic machinery, tools, engines, etc., built to order ; patents secured and inventions developed. Box 434, AMER. MACH.

Small shop for sale ; well equipped ; good business ; established 3 years. Address E. Erickeson, 36 Washington North, Boston, Mass.

Purchaser for complete sets of universal radial and plain upright drill patterns with drawings ; for sale cheap. Address "Patterns," care AMERICAN MACHINIST.

Special tools, models, fine light machinery, experimental and electrical work wanted, also specialties to manufacture. The General Mfg. Co., 40 West 13th st., New York City.

Machinery designed, mechanical drawings, blueprints, plans for power-houses, power transmission ; 20 years' experience. "Engineer and Draftsman," Box 344, AM. MACH.

Purchaser for small manufacturing plant in Madison, Wis. ; lot, 100x180 feet ; machine shop, 32x68, two story, with line shaft and gasoline power ; foundry, 40x54, new modern equipment ; good location ; for sale cheap. Hart-Parr Co., Charles City, Iowa.

For Sale, Cheap—Two colored tool tempering charts, explaining all tempering to a standard, in oil, water or tallow, making all tools with hard, tough edge, and 40 new steel-working receipts ; all for $1. W. M. Toy, Sidney, O. (40 years a factory steel worker).

Wants.

Situation and Help Advertisements only inserted under this head. Rate 25 cents a line for each insertion. About six words make a line. No advertisements under two lines accepted, and no advertisements abbreviated. The cash and copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded. Applicants may specify names to which their replies are not to be forwarded ; but replies will not be returned. If not forwarded they will be destroyed without notice. Original letters of recommendation or other papers of value should not be enclosed to unknown correspondents.

Situations Wanted.

Mechanical draftsman, graduate, wants position. Box 437, AMERICAN MACHINIST.

Experienced draftsman is open for engagement. Box 438, AMERICAN MACHINIST.

Draftsman, mechanical, 12 years' experience, desires position. Box 406, AM. MACH.

Experienced draftsman wants position ; electrical works preferred. Box 424, AM. M.

20 years designing, machinery, inventions ; work home ; situation. 433 Dekalb av., B'klyn.

Mechanical draftsman, experienced on cranes, wishes position. Box 430, AM. MACH.

Factory superintendent, varied experience, desires change. Box 439, AMER. MACHINIST.

Mechanical draftsman, experienced designer, wants position near New York. Box 431, AMERICAN MACHINIST.

First-class metal pattern maker (understands molding machine) wants position. Box 418, AMERICAN MACHINIST.

Mechanical draftsman, young man, with 2 years' experience, good references, wishes a change. Box 423, AMERICAN MACHINIST.

Experienced young man desires position in charge of grinding or milling job, designing tools and fixtures. Address Box 421, AM. M.

Mechanical engineer ; 25 years' experience, marine and Corliss engine work ; estimater, designer and shop superintendent. Box 409, AMERICAN MACHINIST.

Wanted—A position as mechanical engineer or assistant, by a university graduate and machinist, experienced in drafting. Box 426, AMERICAN MACHINIST.

An up-to-date foreman of foundry wishes to make a change ; good reasons for changing ; strictly temperate and steady. G. Roice, Winthrop Hotel, New Haven, Conn.

Practical foreman ; 12 years' experience in economical repairs on all kinds of machinery, also toolmaking, gear cutting and blacksmithing. Box 413, AMERICAN MACHINIST.

Tool designer wants position ; expert at designing tools, jigs, fixtures, etc., for reducing the cost of manufactured articles. Wm. H. Flood, 308 W. 123d st., New York City.

An erecting engineer, 25 years' experience with general machinery, desires position as master mechanic of mill or factory ; best references given. Box 420, AMER. MACH.

A position as manual training instructor in machine shop practice, by a first-class mechanic ; has had some experience as instructor in manual training. P. M., care AM. MACH.

Position in New York as chief draftsman or designer ; large experience on light automatic, adding, typewriter, linotype, paper-working machines, tools and fixtures. Box 433, A. M.

Position by practical foundry foreman ; range of work from gated bench castings to 30 tons ; familiar with modern foundry practice in detail ; A1 reference. Box 419, A. M.

Mechanical engineer desires to change ; well up in design of high-speed engines, boilers and refrigerating plants ; American, English and foreign experience ; age 33. Address Box 432, AMERICAN MACHINIST.

As machinist in power-house ; have had 4 years' experience in 10,000 H.-P. plant ; have had charge of turbines and generators ; first-class references ; start about June 3. Address Box 415, AMERICAN MACHINIST.

Wanted—Position as pusher or assistant superintendent ; I can get your work from the foundry to cars on time ; 8 years' experience in large, up-to-date machine shop. Address "Pusher," care AMERICAN MACHINIST.

Position as superintendent or foreman, by practical mechanic, up to date in modern methods, organizing and the handling of men to obtain best results ; interchangeable machinery and specialties. Box 348, AM. M.

Aggressive, educated man of brains, 34, machinist draftsman, on fine precision tools and dies, designed automatic machines, superintended, wishes place as foreman or designing toolmaker. Box 435, AMERICAN MACHINIST.

Technical graduate, 3 years' practical experience in shop and general engineering work, at present with large manufacturing company in New York city, wishes to change and locate in or near New York city ; good reference. Box 416, AMERICAN MACHINIST.

By experienced superintendent of machine shop and foundry ; modern, aggressive, good executive ; technical graduate ; wide general experience ; now with concern manufacturing pumping machinery ; soon open to engagement. Box 402, AMERICAN MACHINIST.

As mechanical engineer or master mechanic ; a wide experience in plant construction, drafting material, contracts, labor, etc. ; at present engaged in cotton mill engineering ; abundant references furnished, including present employers. Address Box 422, AMER. MACHINIST.

A mechanical engineer and designer with a lengthy experience as a patent attorney desires engagement, for all or part of his time, as designer and counsel on patent matters, with manufacturer or party interested in developing or manufacturing a new or patented line ; references and guarantees given. Box 414, AMERICAN MACHINIST.

Superintendent.—Position as superintendent or general foreman, by a thorough, all-round mechanic and business man ; familiar with every detail of building machinery and manufacturing specialties and small interchangeable parts ; only those needing an A1 man and willing to pay a good salary need reply. Box 425, AMERICAN MACHINIST.

Mechanical engineer, widely experienced, inventing and constructing labor-saving, intricate automatic machinery, devising special processes, etc., may be engaged for temporary or permanent work ; technical graduate ; member A. S. M. E., etc. ; advertiser will not work for less than $500 per month, but guarantees satisfaction and results in anything he undertakes. Box 429, AMERICAN MACHINIST.

Help Wanted.

Machinists to sell my calipers, etc. ; big inducements. E. G. Smith, Columbia, Pa.

Wanted—Two good, all-round machinists on crane work. Address Box 440, AM. MACH.

Wanted—A number of good patternmakers. Call or address De Laval Steam Turbine Co., Trenton, N. J.

Wanted—First-class die-sinker. Address, giving experience and references, Wyman & Gordon, Worcester, Mass.

Wanted—Several good patternmakers, by a machine tool manufacturing works in Jersey. Box 179, AMERICAN MACHINIST.

Wanted—Two competent men on hand and automatic screw machines. Address "Automatic," care AMERICAN MACHINIST.

Wanted—First-class toolmakers and machinists, also patternmakers, in the Middle West. Box 411, AMERICAN MACHINIST.

Six first-class molders for Corliss engines and other heavy machine castings. Address "Manufacturer," care AMER. MACHINIST.

Wanted—Capable and energetic foundry foreman for Eastern shop making heavy castings. Apply, stating salary, to Box 417, A. M.

Wanted—Ten good patternmakers ; permanent positions ; state wages expected. The Balkwill Pattern Works, 970 Hamilton st., Cleveland, O.

Machinists wanted to act as shop agents and sell small tools where they work. Address E. H. Randall, 235 Woodland ave., Springfield, Ohio.

Wanted—A few first-class detail or leading draftsmen on locomotive work ; give age, experience, education and salary expected. Box 388, AMERICAN MACHINIST.

Wanted—Several first-class water-tube boiler erectors ; none but experienced, industrious men need apply. Write or call on Abendroth & Root Mfg. Co., Newburgh, N. Y.

Wanted—First-class machinists, for steady employment in Greater New York ; married men preferred ; in application give experience, references, age and wages expected. Box 396, AMERICAN MACHINIST.

Men to sell new copyrighted tables on commission to toolmakers, machinists, apprentices, superintendents, foremen and proprietors, during leisure hours. Address Box 427, AMERICAN MACHINIST.

First-class electrical and mechanical draftsman wanted ; American graduate preferred. Address, enclosing references and stating salary expected, Chief Draftsman, Crocker-Wheeler Company, Ampere, N. J.

First-class tool and die maker ; must understand the laying out of dies ; steady position for right party ; shop in New York city ; state wages and where last employed. Address C. E. D., care AMERICAN MACHINIST.

Machinists Wanted—We need 30 lathe hands and 20 planer hands for night gang on heavy machine tool work ; to work 12 hours per night, five nights per week ; good pay to good men. Apply to The Pond Machine Tool Co., Plainfield, N. J.

We are enlarging our works, and will shortly require an increased number of skilled mechanics ; we invite application from pattern makers, molders and machinists. Ad-

dress the Westinghouse Machine Company, East Pittsburgh, Pa.

Wanted—Draftsman experienced in heavy punching and coping machines, plate rolls, angle shears and other machines for heavy structural material. Address, with proofs of competency and salary expected, B. S. C., care AMERICAN MACHINIST.

Wanted—Foreman for machine shop and one for foundry, in growing engine works in Pennsylvania city of 40,000; employ 10 to 25 men in each department; permanent positions and good pay to right parties. M. L. Co., care AMERICAN MACHINIST.

Engineers, firemen, machinists and electricians, send for 40-page pamphlet containing questions asked by Examining Board of Engineers to obtain engineer's license. Address Geo. A. Zeller, Publisher, Room 590, 18 S. 4th st., St. Louis, Mo.

Foreman for small machine shop; one who understands die and other work and is willing to get in and hustle with the rest of the men; good position for the right man; name salary expected and where last employed. Address W. H. S., care AMERICAN MACHINIST.

Wanted—Manager for machine tool works, competent to assume full management, fully conversant with up-to-date wants and methods; deceased party's stock; whole or part could be secured; give full particulars. Address Box 389, AMERICAN MACHINIST.

First-class man who understands boring and drilling and the building of small foot and power presses; good, steady position for the right man; located in New York city; reference required and state salary expected. Address Box X. Y. Z., care AMER. MACHINIST.

Competent office man with sufficient mechanical knowledge to properly manage old-established gas engine works; state salary expected, experience, age, etc.; a working interest also at present and stock later if agreeable. Address "Chance," care AMER. MACH.

Wanted—Thoroughly competent foreman on machine tool building, experienced in building pipe threading machinery, familiar with methods of producing duplicate parts on turret lathes; give age, experience, salary expected and references. Box 387, AMER. MACH.

Wanted—A thoroughly competent foreman for a machine shop of some pretensions; a technical graduate with up-to-date ideas of the most approved machine shop practice preferred; an excellent opportunity near New York for the right man. Address Box, 397, AMERICAN MACHINIST.

Wanted.—Men with brains wanted, who can make drawings requiring technical training and practical engineering experience; no draftsmen need apply; commensurate salary for proved ability; in replying give age, references, experience and salary. Address Box 412. AMERICAN MACHINIST.

Wanted—By Western manufacturing concern, assistant superintendent of mechanical education and experience, especially in gas engine work; good opening for energetic man of ability; give full particulars of past experience, references and salary expected. Box 436, AMERICAN MACHINIST.

Wanted—Thoroughly competent foreman for automatic and hand screw machine department; must be familiar with Cleveland and Hartford style of automatic screw machines and capable of turning out accurate work; give age, experience, salary expected and references. Box 381, AMER. MACHINIST.

Wanted—Engineer for small steam and electric plant 20 miles from New York; must be capable taking charge of steam, hydraulic and electric machinery and storage battery; have some knowledge of drawing; must speak German; state experience, references, wages, etc. Address "Factory," P. O. Box 6, Branch O, New York City.

Wanted.—Designer wanted by prosperous and established manufacturer in Middle West, to work on adding machines. Splendidly equipped shop. Only high-class, experienced man desired. Position is very desirable and will pay well. State particulars as to experience and salary. Address immediately Box 386, AMERICAN MACHINIST.

Working foreman wanted for small foundry in New England; a young man who thoroughly understands molding and the mixing and melting of iron and can turn out good castings at a reasonable cost; should prefer a man who knows something about brass founding; good pay and a permanent situation to the right man. Address, giving experience, references and age, Box 428, AMER. MACH.

Wanted—A thoroughly competent foreman of a machine shop manufacturing automatic machinery; to an experienced man understanding modern shop practice and competent to organize and maintain an economical system of making interchangeable machinery, an exceptional opportunity is offered. Address, stating salary required, experience and references, "Interchangeable," care AMER. MACH.

Wanted—General foreman or superintendent for large machine shop in Ohio doing general machine work and building gas engines; must be a thorough mechanic and familiar and experienced in gas engine work and handling men under piece or premium systems; must also be familiar with foundry practice and pattern work; state age, experience, married or single, salary, etc. Address H. D. C., care AMERICAN MACHINIST.

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Curtis & Co. Mfg. Co., St. Louis, Mo.
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Brown & Sharpe Mfg. Co., Providence, R. I.
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Gay & Ward, Athol, Mass.
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Bickford Drill & Tool Co., Cincinnati, O.
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Niles Tool Works Co., New York.
Pond Mach. Tool Co., New York.

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Baker Bros., Toledo, O.
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Hill, Clarke & Co., Boston, Mass.
Niles Tool Works Co., New York.
Pond Mach. Tool Co., New York.
Reade Mchry. Co., Cleveland, O.

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Niles Tool Works Co., New York.
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Barnes Co., B. F., Rockford, Ill.
Barnes Co., W. F. & John, Rockford, Ill.
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Bement, Miles & Co., New York.
Niles Tool Works Co., New York.

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See Grinding Wheels.

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Consolidated Engine Stop Co., New York.

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Charter Gas Engine Co., Sterling, Ill.
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Foos Gas Eng. Co., Springfield, O.
Maywood Foundry & Mach. Co., Chicago, Ill.
Mietz, August, New York.
New Era Iron Wks., Dayton, O.
Olds Motor Wks., Lansing, Mich.
Patterson, Gottfried & Hunter, Ltd., New York.
Pierce-Crouch Engine Co., New Brighton, Pa.
Regal Gas Engine Co., Coldwater, Mich.
Springfield Gas Eng. Co., Springfield, O.
Stover Engine Works, Freeport, Ill.
Struthers, Wells & Co., Warren, Pa.
Weber Gas & Gasoline Eng. Co., Kansas City, Mo.

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Buffalo Forge Co., Buffalo, N. Y.

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Miner & Peck Mfg. Co., New Haven, Conn.

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Wyman & Gordon, Worcester, Mass.

Forgings, Hydraulic
Wyman & Gordon, Worcester, Mass.

Forgings, Steel
Westmoreland Steel Co., Pittsburg, Pa.
Wyman & Gordon, Worcester, Mass.

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Starrett Co., L. S., Athol, Mass.

Gages, Recording
Bristol Co., Waterbury, Conn.

Gages, Steam
Crosby Steam Gage & Valve Co., Boston, Mass.

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Harrington & Son Co., Edwin, Philadelphia, Pa.
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Walcott & Son, Geo. D., Jackson, Mich.
Whiton Machine Co., D. E., New London, Conn.

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Cleveland Gear Wks., Cleveland, O.
Fawcus Mach. Co., Pittsburgh, Pa.
Fellows Gear Shaper Co., Springfield, Vt.
Gleason Tool Co., Rochester, N. Y.
Gould & Eberhardt, Newark, N. J.
Grant Gear Works, Boston, Mass.
Hardinge Bros., Chicago, Ill.
Harrington, Son & Son, Edwin, Philadelphia, Pa.
Horsburgh & Scott, Cleveland, O.
Messmer Mfg. Co., Ferd., St. Louis, Mo.
New Process Raw Hide Co., Syracuse, N. Y.
Nuttall Co., R. D., Pittsburgh, Pa.
Philadelphia Gear Works, Philadelphia, Pa.
Turley, H. G., St. Louis, Mo.
Van Dorn & Dutton Co., Cleveland, O.
Walcott & Son, Geo. D., Jackson, Mich.

Gears, Molded
Farrel Foundry & Mach. Co., Ansonia, Conn.
Greenwald Co., I. & E., Cincin., O.
Poole & Son Co., Robt., Baltimore, Md.

Gears, Rawhide
Chicago Raw Hide Co., Chicago, Ill.
New Process Raw Hide Co., Syracuse, N. Y.
Nuttall Co., R. D., Pittsburgh, Pa.

Gears, Worm
Albro-Clem Elevator Co., Philadelphia, Pa.
Fawcus Mach. Co., Pittsburgh, Pa.
Morse, Williams & Co., Phila., Pa.
Nuttall Co., R. D., Pittsburgh, Pa.
Van Dorn & Dutton Co., Cleveland, O.

Graphite
Dixon Crucible Co., Jos., Jersey City, N. J.
Obermayer Co., S., Cincinnati, O.

Grinders, Center
Heald & Son, L. S., Barre, Mass.
Hisey-Wolf Mach. Co., Cincin., O.
Leland & Faulconer Mfg. Co., Detroit, Mich.

Grinders, Cock
Windsor Mach. Co., Windsor, Vt.

Grinders, Cutter
Adams Co., Dubuque, Iowa.
Automatic Mach. Co., Greenfield, Mass.
Cincinnati Milling Mach. Co., Cincinnati, O.
Garvin Mach. Co., New York.
Gleason Mach. Works, F., Philadelphia, Pa.
Gould & Eberhardt, Newark, N. J.
Norton Emery Wheel Co., Worcester, Mass.
Oesterlein Mach. Co., Cincin., O.
Pratt & Whitney Co., Hartford, Conn.
Rivett-Dock Co., Boston, Mass.

Grinders, Drill
Gorton Mach. Co., Geo., Racine, Wis.
Heald & Son, L. S., Barre, Mass.
Standard Tool Co., Cleveland, O.
Washburn Shops, Worcester, Mass.
Wilmarth & Morman Co., Grand Rapids, Mich.

Grinders, Disc
Besly & Co., Chas. H., Chicago, Ill.
Gorton Mach. Co., Geo., Racine, Wis.
Iroquois Mach. Co., Provi., R. I.
Ransom Mfg. Co., Oshkosh, Wis.

Grinders, Saw
Keystone Mach. Tool Wks., Philadelphia, Pa.

Grinders, Tool
Barnes Co., B. F., Rockford, Ill.
Barnes Co., W. F. & John, Rockford, Ill.
Diamond Mach. Co., Prov., R. I.
Gisholt Mach. Co., Madison, Wis.
Iroquois Mach. Co., Provi., R. I.
Landis Tool Co., Waynesboro, Pa.
Leland & Faulconer Mfg. Co., Detroit, Mich.
Northampton Emery Wheel Co., Leeds, Mass.
Oesterlein Mach. Co., Cincin., O.
Ransom Mfg. Co., Oshkosh, Wis.
Safety Emery Wheel Co., Springfield, O.
Whitney Mfg. Co., Hartford, Ct.

Grinding Machines
Besly & Co., Chas. H., Chicago, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Builders' Iron Foundry, Providence, R. I.
Diamond Mach. Co., Prov., R. I.
Goodell-Pratt Co., Greenfield, Mass.
Gorton Mach. Co., Geo., Racine, Wis.
Hill, Clarke & Co., Boston, Mass.
Hisey-Wolf Machine Co., Cin., O.
Iroquois Mach. Co., Provi., R. I.
Landis Tool Co., Waynesboro, Pa.
Northampton Emery Wheel Co., Leeds, Mass.
Northern Elec. Mfg. Co., Madison, Wis.
Norton Emery Wheel Co., Worcester, Mass.
Ransom Mfg. Co., Oshkosh, Wis.
Safety Emery Wheel Co., Springfield, Mass.
Vitrified Wheel Co., Westfield, Mass.
Washburn Shops, Worcester, Mass.
Webster & Perks Tool Co., Springfield, O.
Wilmarth & Morman Co., Grand Rapids, Mich.

Grinding Wheels
Abrasive Material Co., Phila., Pa.
Builders' Iron Foundry, Providence, R. I.
Carborundum Co., Niagara Falls, N. Y.
Diamond Mach. Co., Provi., R. I.
Hampden Cor. Wheel Co., Brightwood, Mass.
Northampton Emery Wheel Co., Leeds, Mass.
Norton Emery Wheel Co., Worcester, Mass.
Safety Emery Wheel Co., Springfield, O.
Vitrified Wheel Co., Westfield, Mass.

Grindstones
Cleveland Stone Co., Cleveland, O.

Gun Barrel Machinery
Bement, Miles & Co., New York.
Diamond Mach. Co., Provi., R. I.
Niles Tool Works Co., New York.
Pond Mach. Tool Co., New York.
Reed Co., F. E., Worcester, Mass.

Hack Saw Blades and Frames
Diamond Saw & Stamping Co., Buffalo, N. Y.
Goodell-Pratt Co., Greenfield, Mass.
Starrett Co., L. S., Athol, Mass.
West Haven Mfg. Co., New Haven, Conn.

Hack Saws, Power
Hoefer Mfg. Co., Freeport, Ill.
Olmstead, L. H., Hasbrouck Heights, N. J.
West Haven Mfg. Co., New Haven, Conn.

Hammers, Drop
Bement, Miles & Co., New York.
Billings & Spencer Co., Hartford, Conn.
Bliss Co., E. W., Brooklyn, N. Y.
Merrill Bros., Brooklyn, N. Y.
Miner & Peck Mfg. Co., New Haven, Conn.
Williams, White & Co., Moline, Ill.

Hammers, Pneumatic
Chicago Pneumatic Tool Co., Chicago, Ill.
Cleveland Pneumatic Tool Co., Cleveland, O.
Dallett & Co., Thos. H., Phila., Pa.
Phila. Pneu. Tool Co., Philadelphia, Pa.

Hammers, Steam
Bement, Miles & Co., New York.
Bethlehem Fdry. & Mach. Co., So. Bethlehem, Pa.
Cleveland Punch & Shear Wks. Co., Cleveland, O.
Pittsburgh Shear Knife & Mach. Co., Pittsburgh, Pa.

Handles, Machine Tool
Norwood Bicycle Co., Cincin., O.
Schacht Mfg. Co., Cincinnati, O.

Heads, Exhaust
Burt Mgf. Co., Akron, O.

Heating Machines, Automatic
Am. Gas Furnace Co., New York.

Heating and Ventilating Apparatus
Amer. Blower Co., Buffalo, N. Y.
Buffalo Forge Co., Buffalo, N. Y.

Hoists, Electric
C & C Electric Co., New York.
Hunt Co., C. W., West New Brighton, N. Y.
Northern Engineering Works, Detroit, Mich.
Pawling & Harnischfeger, Milwaukee, Wis.

Hoists, Hand
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Moyer & Co., J. W., Philadel., Pa.
Yale & Towne Mfg. Co., New York.

Hoists, Pneumatic
Chicago Pneumatic Tool Co., Chicago, Ill.
Cleveland Pneumatic Tool Co., Cleveland, O.
Curtis & Co. Mfg. Co., St. Louis, Mo.
Northern Engineering Wks., Detroit, Mich.
Rand Drill Co., New York.
Whiting Fdry. Equipment Co., Harvey, Ill.

Hoisting and Conveying Machinery
Brown Hoisting Mchry. Co., New York.
Caldwell & Son Co., H. W., Chicago, Ill.
Hunt Co., C. W., West New Brighton, N. Y.
Link Belt Engineering Co., Philadelphia, Pa.
Moyer & Co., J. W., Philadel., Pa.
Niles-Bement-Pond Co., New York.

Holder, File and Tool
Bowers, Geo. W., Waltham, Mass.

Igniter, Gas Engine
Franklin Mfg. Co., Syracuse, N. Y.
Maxwell Engr. Co., Rome, N. Y.

Indicators, Speed
Starrett Co., L. S., Athol, Mass.
Woodman Mfg. & Supply Co., R., Boston, Mass.

Indicators, Steam
Crosby Steam Gage & Valve Co., Boston, Mass.

Inspection and Tests
Hunt Co., Robt. W., Chicago, Ill.

Injectors
Lunkenheimer Co., Cincinnati, O.
Rue Mfg. Co., Philadelphia, Pa.
Sellers & Co., Wm., Phila., Pa.

Instruction Schools
See Schools, Correspondence.

Jacks, Hydraulic
Bethlehem Fdry. & Mch. Co., So Bethlehem, Pa.
Watson-Stillman Co., New York.

Keys, Machine
Whitney Mfg. Co., Hartford, Ct.

Key Seaters
Baker Bros., Toledo, O.
Bement, Miles & Co., New York.
Chattanooga Mchy. Co., Chattanooga, Tenn.
Davis Mach. Co., W. P., Rochester, N. Y.
Hill Tool Co., Anderson, Ind.
Mitts & Merrill, Saginaw, Mich.

Lamps, Arc
General Electric Co., N. Y. City.
Gen. Incan. Arc Light Co., N. Y. City.
Western Electric Co., Chicago, Ill.
Westinghouse Elec. & Mfg. Co., Pittsburgh, Pa.

Lathe Dogs
Armstrong Bros. Tool Co., Chicago, Ill.
Besly & Co., Chas. H., Chicago, Ill.
Hill Tool Co., Anderson, Ind.
Le Count, Wm. G., So. Norwalk, Conn.
Pratt & Whitney Co., Hartford Conn.
Schwickart, Ph., Brooklyn, N. Y.

Lathes
American Tool Wks. Co., Cin., O
Automatic Mach. Co., Greenfield
Auto. Mach. Co., Bridgeport, Ct. Mass.
Barker & Chard Mach. T. Co., Cincinnati, O.
Barnes Co., B. F., Rockford, Ill.
Barnes Co., W. F. & John, Rockford, Ill.
Bement, Miles & Co., New York.
Bradford Mach. Tool Co., Cin., O.
Bullard Mach. Tool Co., Bridgeport, Conn.
Davis Mach. Co., W. P., Rochester, N. Y.
Diamond Machine Co., Provi., R. I.
Fay & Scott, Dexter, Me.
Flather & Co., Nashua, N. H.
Garvin Mach. Co., New York.
Grant Tool Co., Franklin, Pa.
Greaves, Klusman & Co., Cin., O.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Hendey Mach. Co., Torrington, Ct.
Hill, Clarke & Co., Boston, Mass.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
McCabe, J. J., New York.
New Haven Mfg. Co., New Haven, Conn.
Niles Tool Works Co., New York.
Pond Mach. Tool Co., New York.
Pratt & Whitney Co., Hartford, Conn.
Reed Co., F. E., Worcester, Mass.
Schumacher & Boye, Cincinnati, O.
Sebastian Lathe Co., Cincin., O.
Seneca Falls Mfg. Co., Seneca Falls, N. Y.
Shepard Lathe Co., Cincinnati, O.
Walcott & Son, Geo. D., Jackson, Mich.
Washburn Shops, Worcester, Mass.

Lathes, Automatic Screw-Threading
Automatic Machine Co., Bridgeport, Conn.

Lathes, Bench
Faneuil Watch Tool Co., Boston, Mass.
Fenn-Sadler Mach. Co., Hartford, Conn.
Waltham Watch Tool Co., Springfield, Mass.

Lathes, Boring
Striet Mach. Co., A., Cincinnati, O.

Letters, Pattern
Butler, A. G., N. Y. City.
Racine Mchry. Co., Racine, Wis.

Levels
Mass. Tool Co., Greenfield, Mass.
Starrett Co., L. S., Athol, Mass.

Lockers, Clothes
Merritt & Co., Philadelphia, Pa.

Locomotives, Shop
Hunt Co., C. W., West New Brighton, N. Y.

Lubricants
Besly & Co., Chas. H., Chicago, Ill.
Dixon Crucible Co., Jos., Jersey City, N. J.

Lubricators
Besly & Co., Chas. H., Chicago, Ill.
Bowen Mfg. Co., Auburn, N. Y.
Crane Co., Chicago, Ill.
Lunkenheimer Co., Cincinnati, O.

Machinery Builders, Special
American Fdry. & Mach. Co., Hanover, Pa.
Blanchard Mach. Co., The, Boston, Mass.
Columbia Factory, Hartford, Ct.
Hardinge Bros., Chicago, Ill.
Pratt & Whitney Co., Hartford, Conn.
Stowell, J. A., Leominster, Mass.
Walters, E. P., Bridgeport, Conn.

Machine Screws
Worcester Mach. Screw Co., Worcester, Mass.

Machinists' Small Tools
Besly & Co., Chas. H., Chicago, Ill.
Billings & Spencer Co., Hartford, Conn.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Twist Drill Co., Cleveland, O.
Hammacher, Schlemmer & Co., New York.
Mass. Tool Co., Greenfield, Mass.
Patterson, Gottfried & Hunter, Ltd., New York.
Reichhelm & Co., E. P., New York.
Sawyer Tool Mfg. Co., Fitchburg, Mass.
Slocomb & Co., J. T., Provi., R. I.
Starrett Co., L. S., Athol, Mass.
Tracy, Robinson & Williams, Hartford, Conn.
Turner & Co., F. L., Orange, Mass.
Wyke & Co., J., East Boston, Mass.

Measuring Machines
Rogers, John M., Boat, Gage & Drill Works, Gloucester City, N. J.

Mandrels, Expanding
Nicholson & Son, W. H., Wilkesbarre, Pa.

Mandrels, Solid
Cleveland Twist Drill Co., Cleveland, O.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Rogers, John M., Boat, Gage & Drill Works, Gloucester City, N. J.
Standard Tool Co., Cleveland, O.

Micrometer Calipers
Brown & Sharpe Mfg. Co., Providence, R. I.
Sawyer Tool Mfg. Co., Fitchburg, Mass.
Slocomb & Co., J. T., Providence, R. I.
Starrett Co., L. S., Athol, Mass.
Syracuse Twist Drill Co., Syracuse, N. Y.

Milling Attachments
The Adams Co., Dubuque, Iowa.
Cincinnati Milling Mach. Co., Cincinnati, O.
Kempsmith Mfg. Co., Milwaukee, Wis.
Oesterlein Mach. Co., Cincin., O.

Milling Machines, Bench
Faneuil Watch Tool Co., Boston, Mass.
Waltham Watch Tool Co., Springfield, Mass.

Milling Machines, Horizontal
Adams Co., Dubuque, Iowa.
Beaman & Smith Co., Provi., R. I.
Bement, Miles & Co., New York.
Franklin Mach. Wks., Phila., Pa.
Grant Tool Wks., Franklin, Pa.
Hendey Mach. Co., Torrington, Ct.
Ingersoll Mill. Mach. Co., Rockford, Ill.
Newton Mach. Tool Wks., Philadelphia, Pa.
Niles Tool Works Co., New York.
Pratt & Whitney Co., Hartford, Conn.

Milling Machines, Plain
American Tool Wks. Co., Cin., O.
Bement, Miles & Co., New York.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mach. Co., Cincinnati, O.
Garvin Mach. Co., New York.
Hendey Mach. Co., Torrington, Ct.
Hill, Clarke & Co., Boston, Mass.
Kempsmith Mfg. Co., Milwaukee, Wis.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
Oesterlein Mach. Co., Cincin., O.
Whitney Mfg. Co., Hartford, Ct.

Milling Machines, Vertical
Bement, Miles & Co., New York.
Brown & Sharpe Mfg. Co., Providence, R. I.
Garvin Mach. Co., New York.
Ingersoll Mill. Mach. Co., Rockford, Ill.
Newton Mach. Tool Wks., Philadelphia, Pa.
Niles Tool Works Co., New York.
Pratt & Whitney Co., Hartford, Conn.
Quint, A. D., Hartford, Conn.

Milling Machines, Portable
Underwood & Co., H. B., Philadelphia, Pa.

Milling Machines, Universal
American Tool Wks. Co., Cin., O.
Bement, Miles & Co., New York.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mach. Co., Cincinnati, O.
Garvin Mach. Co., New York.
Hendey Mach. Co., Torrington, Ct.
Hill, Clarke & Co., Boston, Mass.
Kempsmith Mfg. Co., Milwaukee, Wis.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
Niles Tool Works Co., New York.
Oesterlein Mach. Co., Cincin., O.
Waltham Watch Tool Co., Springfield, Mass.

Milling Tools, Adjustable
Geometric Drill Co., Westville, Ct.
Rogers, Boat, Gage & Drill Wks., John M., Gloucester City, N. J.

Molding Machines
The Adams Co., Dubuque, Iowa.
Tabor Mfg. Co., Philadelphia, Pa.
Webster & Perks Tool Co., Springfield, O.

Molds, Hammer and Vise Jaw
Field, Chas. H., Providence, R. I.

Mortising Machines, Chain
New Britain Mch. Co., New Britain, Conn.

Motors, Electric
Akron Elec. Mfg. Co., Akron, O.
C & C Electric Co., New York.
Commercial Electric Co., Indianapolis, Ind.
Crocker-Wheeler Co., Ampere, N. J.
Eck Dynamo & Motor Works, Belleville, N. J.
General Electric Co., New York.
General Incan. Arc Light Co., New York.
Jantz & Leist Elec. Co., Cin., O.
Northern Elec. Mfg. Co., Madison, Wis.
Robbins & Myers Co., Springfield, Ohio.
Roth Bros. & Co., Chicago, Ill.
Sprague Electric Co., New York.
Triumph Elec. Co., Cincinnati, O.
Western Electric Co., Chicago, Ill.
Westinghouse Elec. & Mfg. Co., Pittsburgh, Pa.

Name Plates
Franklin Mfg. Co., Syracuse, N. Y.
Murdock Parlor Grate Co., Boston, Mass.

Nut Tappers
See Bolt and Nut Machinery.

Oil Cups and Covers
Bay State Stamping Co., Worcester, Mass.
Besly & Co., Chas. H., Chicago, Ill.
Bowen Mfg. Co., Auburn, N. Y.
Crane Co., Chicago, Ill.
Lunkenheimer Co., Cincinnati, O.
The Winkley Co., Hartford, Conn.

Oils
Besly & Co., Chas. H., Chicago, Ill.
Houghton & Co., E. F., Philadelphia, Pa.

Packing, Metallic
U. S. Metallic Packing Co., Philadelphia, Pa.

Packing, Steam Joint
Jenkins Bros., New York.

Pans and Tote Boxes, Steel
Kilbourne & Jacobs Mfg. Co., Columbus, O.

Pans, Lathe
New Britain Mch. Co., New Britain, Conn.

Patents
Baldwin, Davidson & Wight, Washington, D. C.
Bevans, James W., Washington, D. C.
Cromwell, W. H., Washington, D. C.
Cullen, Orlan Clyde, Washington, D. C.
Patent Title & Guarantee Co., New York.
Stevens & Co., Milo B., Washington, D. C.

Pattern Shop Machinery
American Machinery Co., Grand Rapids, Mich.
Baker Bros., Toledo, O.
Fay & Scott, Dexter, Me.
Field, Chas. H., Providence, R. I.
Greaves, Klusman & Co., Cin., O.

Patterns, Wood
Balkwill Pattern Works, Cleveland, Ohio.
Gobeille Pattern Co., Cleveland, O.
Olmstead Co., H. B., New York.

Pipe and Fittings
Crane Co., Chicago, Ill.

Pipe Cutting and Threading Machines
Bignall & Keeler Mfg. Co., Edwardsville, Ill.
Curtis & Curtis Co., Bridgeport, Conn.
Merrell Mfg. Co., Toledo, O.
Oster Mfg. Co., Cleveland, O.
Saunders' Sons, D., Yonkers, N. Y.
Wells Bros. Co., Greenfield, Mass.

Pipe Fitters' Tools
Cleveland Twist Drill Co., Cleveland, O.
Saunders' Sons, D., Yonkers, N. Y.
Standard Tool Co., Cleveland, O.

Planer, Jack
Armstrong Bros. Tool Co., Chicago, Ill.

Planers
Amer. Tool Wks. Co., Cincin., O.
Bartlett, E. E., Boston, Mass.
Belmer-Eames Tool Co., Cin., O.
Bement, Miles & Co., New York.
Betts Mach. Co., Wilmington, Del.
Cincinnati Planer Co., Cincin., O.
Detrick & Harvey Mch. Co., Baltimore, Md.
Flather Planer Co., Mark, Nashua, N. H.
Garvin Mach. Co., New York.
Gray Co., G. A., Cincinnati, O.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Hendey Mach. Co., Torrington, Ct.
Hill, Clarke & Co., Boston, Mass.
Niles Tool Works Co., New York.
New Haven Mfg. Co., New Haven, Conn.
Pond Mach. Tool Co., New York.
Sellers & Co., Wm., Phila., Pa.
Walters, E. P., Bridgeport, Conn.
Whitcomb Mfg. Co., Worcester, Mass.
Woodward & Powell Planer Co., Worcester, Mass.

Planers, Portable
Morton Mfg. Co., Muskegon Heights, Mich.
Underwood & Co., H. B., Philadelphia, Pa.

Planers, Rotary
Bement, Miles & Co., New York.
Franklin Mach. Wks., Phila., Pa.
Keystone Mach. Tool Wks., Philadelphia, Pa.
Newton Mch. Tool Works, Philadelphia, Pa.
Pond Mach. Tool Co., New York.
Underwood & Co., H. B., Phila., Pa.

Presses, Hydraulic
Bement, Miles & Co., New York.
Watson-Stillman Co., New York.

Presses, Power
Automatic Mach. Co., Bridgeport, Conn.
Bethlehem Fdry. & Mch. Co., So. Bethlehem, Pa.
Bliss Co., E. W., Brooklyn, N. Y.
Mossberg & Granville Mfg. Co., Providence, R. I.

Profilers
Garvin Mach. Co., New York.

Pulley Turning and Boring Machines
Harrington, Son & Co., Edwin, Philadelphia, Pa.
New Haven Mfg. Co., New Haven, Conn.
Niles Tool Works Co., New York.
Striet Mch. Co., A., Cincinnati, O.

Pulleys
Cresson Co., Geo. V., Philadel., Pa.
Howard Iron Wks., Buffalo, N. Y.
Jones Fdry. & Mch. Co., W. A., Chicago, Ill.
Poole & Son Co., Robt., Baltimore, Md.
Reeves Pulley Co., Columbus, Ind.

Pulleys, Friction Cone
Evans Friction Cone Co., Boston, Mass.

Pumps, Hydraulic
Watson-Stillman Co., New York.

Punches, Hydraulic
Bement, Miles & Co., New York.
Bethlehem Fdry. & Mch. Co., So. Bethlehem, Pa.
Watson-Stillman Co., New York.

Punches, Power
Bliss Co., E. W., Brooklyn, N. Y.
Bremer Mach. & Tool Co., Kalamazoo, Mich.
Buffalo Forge Co., Buffalo, N. Y.
Cleveland Punch & Shear Wks., Cleveland, O.
Hilles & Jones Co., Wilmington, Del.
Long & Allstatter Co., Hamilton, Ohio.
Pittsburg Shear Knife & Mch. Co., Pittsburgh, Pa.
Reade Mchry. Co., Cleveland, O.
Williams, White & Co., Moline, Ill.

Rack Cutting Machines
Fellows Gear Shaper Co., Springfield, Vt.
Gould & Eberhardt, Newark, N. J.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
Reed Co., F. E., Worcester, Mass.
Walcott & Son, Geo. D., Jackson, Mich.

Racks, Cut
Fellows Gear Shaper Co., Springfield, Vt.
Nuttall Co., R. D., Pittsburgh, Pa.
Van Dorn & Dutton Co., Cleve., O.
Walcott & Son, Geo. D., Jackson, Mich.

Racks, Tool
New Britain Mach. Co., New Britain, Conn.

Reamers
Chadwick & Co., J. B., Portsmouth, N. H.
Cleveland Twist Drill Co., Cleveland, O.
Clough, R. M., Tolland, Conn.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt & Whitney Co., Hartford, Conn.
Rogers, John M., Boat, Gage & Drill Works, Gloucester City, N. J.
Standard Tool Co., Cleveland, O.
Wells Bros. Co., Greenfield, Mass.

Reaming Stands
Flather Planer Co., Mark, Nashua, N. H.

Rheostats
General Incan. Arc Light Co., New York.

Riveters, Hydraulic
Bement, Miles & Co., New York.
Watson-Stillman Co., New York.

Riveters, Pneumatic
Bement, Miles & Co., New York.
Cleveland Pneumatic Tool Co., Cleveland, O.

Riveting Machines
Bement, Miles & Co., New York.
Bethlehem Foundry & Mach. Co., So. Bethlehem, Pa.
Long & Allstatter Co., Hamilton, Ohio.

Roller and Ball Bearings
Amer. Roller Bearing Co., Boston, Mass.
Ball Bearing Co., Philadel., Pa.
Mossberg & Granville Mfg. Co., Providence, R. I.
Roller Bearing & Equipment Co., Keene, N. H.

Rolling Mill Machinery
Cleveland Punch & Shear Wks. Co., Cleveland, O.
Diamond Drill & Mch. Co., Birdsboro, Pa.
Hilles & Jones Co., Wilmington, Del.
Mossberg & Granville Mfg. Co., Providence, R. I.
Pratt & Whitney Co., Hartford, Conn.

Safety Valves, Pop
Crane Co., Chicago, Ill.
Crosby Steam Gage & Valve Co., Boston, Mass.
Lunkenheimer Co., Cincinnati, O.

Sand Blast Apparatus
Paxson Co., J. W., Philadel., Pa.

Sand Mixing Machines
Smith Foundry Supply Co., J. D., Cleveland, O.

Sawing Machines, Metal
Cleveland Punch & Shear Works Co., Cleveland, O.
Keystone Mach. Tool Wks., Philadelphia, Pa.
Newton Mach. Tool Works, Philadelphia, Pa.
Pratt & Whitney Co., Hartford, Conn.
Reade Mchry. Co., Cleveland, O.
West Haven Mfg. Co., New Haven, Conn.

Schools, Correspondence
Amer. School of Correspondence, Boston, Mass.
Consolidated Schools, N. Y. City.
International Correspond. Schools, Scranton, Pa.

Schools, Technical
Mich. College of Mines, Houghton, Mich.

Screw Machines, Automatic
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Machine Screw Co., Cleveland, Ohio.
Dreses, Mueller & Co., Cincin., O.
Windsor Mach. Co., Windsor, Vt.

Screw Machines, Hand
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Mch. Screw Co., Cleveland, O.
Garvin Mach. Co., New York.
Jones & Lamson Mch. Co., Springfield, Vt.
Pearson Mach. Co., Chicago, Ill.
Potter & Johnston Mach. Co., Pawtucket, R. I.
Warner & Swasey Co., Cleveland, Ohio.
Windsor Mach. Co., Windsor, Vt.

Screw Machinery, Wood and Lag
Baker Bros., Toledo, Ohio.
Cook Co., Asa S., Hartford, Conn.

Screw Plates
Besly & Co., Chas. H., Chicago, Ill.
Carpenter Tap & Die Co., J. M., Pawtucket, R. I.
Card Mfg. Co., S. W., Mansfield, Mass.
Hart Mfg. Co., Cleveland, O.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Oster Mfg. Co., Cleveland, O.
Wells Bros. Co., Greenfield, Mass.
Wiley & Russell Mfg. Co., Greenfield, Mass.

Separators, Oil
Amer. Tool & Mach. Co., Boston, Mass.
Springfield Separator Co., Springfield, Vt.

Shafts, Flexible
Chicago Flexible Shaft Co., Chicago, Ill.

Second Hand Machinery
Baird Machy. Co., U., Pittsburgh, Pa.
Bowler & Co., Geo. H., Cleveland, Ohio.
Carlin Mchry. & Supply Co., Atlegeny, Pa.
Dawson, John H., Chicago, Ill.
Fairbanks Co., Philadelphia, Pa.
Garvin Mch. Co., New York.
Hall's Sons, Sam'l, New York.
Hill, Clarke & Co., Boston, Mass.
Marshall & Huschart Mchry. Co., Chicago, Ill.
McCabe, J. J., New York.
Niles Tool Works Co., New York.
Osborn Mchry. Co., New Haven, Conn.
Pratt & Whitney Co., Hartford, Conn.
Prentiss Tool & Supply Co., New York.
Toomey, Frank, Philadelphia, Pa.
Wormer Machy. Co., C. C., Detroit, Mich.

Shapers
Amer. Tool Wks. Co., Cincin., O.
Bement, Miles & Co., New York.
Cincinnati Shaper Co., Cincin., O.
Flather Planer Co., Mark, Nashua, N. H.
Garvin Mach. Co., New York.
Hendey Mach. Co., Torrington, Ct.
Gould & Eberhardt, Newark, N. J.

Shapers—*Continued*
Hill, Clarke & Co., Boston, Mass.
Kelly Co., R. A., Xenia, Ohio.
Morton Mfg. Co., Msukegon Heights, Mich.
New Haven Mfg. Co., New Haven, Conn.
Niles Tool Works Co., New York.
Potter & Johnston Mach. Co., Pawtucket, R. I.
Steptoe & Co., John, Cincinnati, O.
Walcott & Son, Geo. D., Jackson, Mich.

Shears, Power
Bethlehem Fdry. & Mch. Co., So. Bethlehem, Pa.
Bliss Co., E. W., Brooklyn, N. Y.
Bremer Mach. & Tool Co., Kalamazoo, Mich.
Buffalo Forge Co., Buffalo, N. Y.
Cleveland Punch & Shear Works, Cleveland, O.
Hilles & Jones Co., Wilmington, Del.
Long & Allstatter Co., Hamilton, Ohio.
Pittsburgh Shear Knife & Mach. Co., Pittsburgh, Pa.
Reade Mchry. Co., Cleveland, O.
Williams, White & Co., Moline, Ill.

Shears, Rotary
Bethlehem Foundry & Mach. Co., So Bethlehem, Pa.
Detrick & Harvey Mach. Co., Baltimore, Md.

Shelving, Shop
New Britain Mach. Co., New Britain, Conn.

Slide Rests
Bartlett Co., E. E., Boston, Mass.
Reed Co., F. E., Worcester, Mass.

Slotters
Baker Bros., Toledo, Ohio.
Bement, Miles & Co., New York.
Betts Mach. Co., Wilmington, Del.
Franklin Mach. Wks., Phila., Pa.
Garvin Mach. Co., New York.
New Haven Mfg. Co., New Haven, Conn.
Newton Mach. Tool Wks., Philadelphia, Pa.
Niles Tool Works Co., New York.

Speed Limit System
Consolidated Engine Stop Co., New York.

Springs
Cleveland Wire Spring Co., Cleveland, O.
Dunbar Bros., Bristol, Conn.

Sprocket Chains
See Driving Chains.

Squares
Turner & Co., F. L., Orange, Mass.

Stamps, Letters and Figures
Schwerdtle Stamp Co., Bridgeport, Conn.

Stampings, Sheet Steel
Automobile & Cycle Parts Co., Cleveland, O.

Steel, Machinery
International Steel & Mchry. Co., New York.
Patriarche & Bell, New York.
Ward & Son, Edgar T., Boston, Mass.

Steel, Sheet
Automobile & Cycle Parts Co., Cleveland, O.
Ward & Son, Edgar T., Boston, Mass.

Steel, Tool
International Steel & Mch. Co., New York.
Patriarche & Bell, New York.
Westmoreland Steel Co., Pittsburgh, Pa.

Straightener, Hydraulic
Bement, Miles & Co., New York.
Watson-Stillman Co., New York.

Straightener, Screw
Towsley Mfg. Co., J. T., Cincin., O.

Swaging Machines
Excelsior Needle Co., Torrington, Conn.

Switchboards
C & C Electric Co., New York.
Triumph Elec. Co., Cincinnati, O.

Taps, Collapsing
Geometric Drill Co., Westville, Ct.

Tapping Machines and Attachments
Baker Bros., Toledo, O.
The Beaman & Smith Co., Providence, R. I.
Bickford Drill & Tool Co., Cin., O.
Cincinnati Mach. Tool Co., Cincinnati, O.
Errington, F. A., N. Y. City.
Fosdick & Holloway Mach. Tool Co., Cincinnati, O.
Garvin Mach. Co., New York.
Geometric Drill Co., Westville, Ct.
Gould & Eberhardt, Newark, N. J.
Pratt & Whitney Co., Hartford, Conn.
Quint, A. D., Hartford, Conn.
Seneca Falls Mfg. Co., Seneca Falls, N. Y.
Webster & Perks Tool Co., Springfield, O.

Taps and Dies
Besly & Co., Chas. H., Chicago, Ill.
Card Mfg. Co., S. W., Mansfield, Mass.
Carpenter Tap & Die Co., J. M., Pawtucket, R. I.
Cleveland Twist Drill Co., Cleveland, O.
Crane Co., Chicago, Ill.
Hammacher, Schlemmer & Co., New York.
Hardinge Bros., Chicago, Ill.
Hart Mfg. Co., Cleveland, O.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Oster Mfg. Co., Cleveland, O.
Pratt & Whitney Co., Hartford, Conn.
Standard Tool Co., Cleveland, O.
Wells Bros. Co., Greenfield, Mass.
Wiley & Russell Mfg. Co., Greenfield, Mass.

Telephone System
Clarke Auto. Telephone Switch Board Co., Providence, R. I.

Threading Dies, Opening
Errington, F. A., New York.
Geometric Drill Co., Westville, Ct.
Jones & Lamson Mch. Co., Springfield, Vt.
Pratt & Whitney Co., Hartford, Conn.

Thread Cutting Tools
Besly & Co., Chas. H., Chicago, Ill.
Hart Mfg. Co., The, Cleveland, O.
Oster Mfg. Co., Cleveland, O.
Pratt & Whitney Co., Hartford, Ct.
Rivett-Dock Co., Boston, Mass.

Tool Holders
Armstrong Bros. Tool Co., Chicago, Ill.
Hill Tool Co., Anderson, Ind.

Tools
See Machinists' Small Tools.

Transmission Machinery
Allston Foundry Co., Boston, Mass.
Caldwell & Son Co., H. W., Chicago, Ill.
Cresson & Co., Geo. V., Phila., Pa.
Jones Fdry. & Mch. Co., W. A., Chicago, Ill.
Link-Belt Engineering Co., Philadelphia, Pa.
Patterson, Gottfried & Hunter, Ltd., New York.
Reeves Pulley Co., Columbus, Ind.

Traps, Steam
Houghton & Co., E. F., Philadelphia, Pa.

Trolleys and Tramways
Brown Hoisting Machy. Co., N. Y. City.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Hunt Co., C. W., West New Brighton, N. Y.
Link Belt Engineering Co., Philadelphia, Pa.
Maris Bros., Philadelphia, Pa.
Moyer & Co., J. W., Philadel., Pa.
Whiting Fdry. Equip. Co., Harvey, Ill.
Yale & Towne Mfg. Co., New York.

Trimmers, Wood
Amer. Mchry. Co., Grand Rapids, Mich.
Leland & Faulconer Mfg. Co., Detroit, Mich.
Washburn Shops, Worcester, Mass.

Trucks, Shop
Towsley Mfg. Co., J. T., Cincin., O.

Tubing, Steel
Shelby Steel Tube Co., Pittsburgh, Pa.

Turrets, Carriage
Fay & Scott, Dexter, Me.

Turret Machines
Amer. Tool & Mach. Co., Boston, Mass.
Automatic Mach. Co., Greenfield, Mass.
Barker & Chard M. T. Co., Cin., O.
Bradford Mach. Tool Co., Cincinnati, O.
Brown & Sharpe Mfg. Co., Providence, R. I.
Bullard Mach. Tool Co., Bridgeport, Conn.
Cleveland Mach. Screw Co., Cleveland, O.
Dreses, Mueller & Co., Cincin., O.
Flather & Co., Nashua, N. H.
Garvin Mach. Co., New York.
Gisholt Mch. Co., Madison, Wis.
Grant Tool Co., Franklin, Pa.
Hill, Clarke & Co., Boston, Mass.
Jones & Lamson Mch. Co., Springfield, Vt.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
Lodge & Shipley Mach. Tool Co., Cincinnati, O.
Niles Tool Works Co., New York.
Pearson Mach. Co., Chicago, Ill.
Potter & Johnston Mach. Co., Pawtucket, R. I.
Warner & Swasey Co., Cleveland, Ohio.
Windsor Mach. Co., Windsor, Vt.

Twist Drills
Cleveland Twist Drill Co., Cleveland, O.
Etna Mfg. Co., New York.
Hammacher, Schlemmer & Co., New York.
Morse Twist Drill & M. Co., New Bedford, Mass.
Standard Tool Co., Cleveland, O.

Universal Joints
Baush Machine Tool Co., Springfield, Mass.
Gray & Prior Mach. Co., Hartford, Conn.

Valves
See Steam Fittings.

Vises, Drill
Hopkinson Mach. Works, Springfield, Mass.

Vises, Metal Workers'
Hammacher Schlemmer & Co., New York.
Howard Iron Wrks., Buffalo, N. Y.
Merrill Bros., Brooklyn, N. Y.
Parker Co., Chas., Meriden, Conn.
Walworth Mfg. Co., Boston, Mass.

Vises, Pipe
Bignall & Keeler Mfg. Co., Edwardsville, Ill.
Curtis & Curtis Co., Bridgeport, Conn.
Saunders' Sons, D., Yonkers, N. Y.
Walworth Mfg. Co., Boston, Mass.

Vises, Planer and Shaper
Cincinnati Planer Co., Cincin., O.
Hendey Mach. Co., Torrington, Ct.
Pratt & Whitney Co., Hartford, Conn.

Vises, Wood Workers'
Hammacher, Schlemmer & Co., New York.
Wyman & Gordon, Worcester, Mass.

Welding Machines
Long & Allstatter Co., Hamilton, Ohio.

Wire-Forming Machinery
Automatic Mach. Co., Bridgeport, Conn.
Mossberg & Granville Mfg. Co., Providence, R. I.

Worm Hobbing Machines
Grant Tool Wks., Franklin, Pa.
Pratt & Whitney Co., Hartford, Conn.

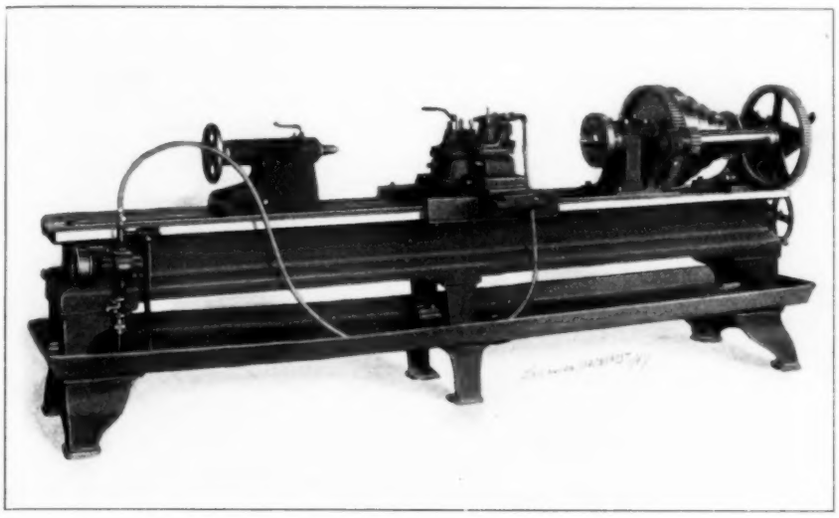
Worm Milling Machines
Cleveland Mach. Screw Co., Cleveland, O.
Pratt & Whitney Co., Hartford, Conn.

Wrenches
Coes Wrench Co., Worcester, Mass.

Wrenches, Drop Forged
Billings & Spencer Co., Hartford, Conn.
Williams & Co., J. H., Brooklyn, N. Y.

Special Turning Lathe.

The half-tones herewith show a new lathe made by the F. E. Reed Company, of Worcester, Mass. This lathe is built



SPECIAL TURNING LATHE.

especially for taking heavy cuts on forgings, spindles and similar work. It will be noticed that the headstock is made in two pieces, carries a large driving cone and powerful back gears. By this arrangement a very powerful drive is obtained without using a wide belt.

The carriage has two tool-posts, each having its own cross-feed screw. The posts can be adjusted vertically, and the one at the rear, being mounted on a slide, with a traverse screw, can also be moved lengthwise of the carriage. Thus the rear tool can be brought up to the cut independently of the tool in front.

The splined feed rod drives two worms in the apron, the feed being thrown in by the two handles shown. The worm at the left is single threaded; the worm at the right is double threaded, thus giving double the feed of the left hand worm. The front tool is set in full depth of cut to be taken and the single-thread worm feed thrown in. Then the back tool is brought in to depth of cut and set by means of its cross adjusting screw so that it will just touch the surface left by the front tool.

The single-thread worm feed is then thrown out and the double worm feed thrown in, thus doubling the feed, while the two tools divide up the cut. The whole lathe is mounted in a pan, and a pump shown at the rear supplies water for cooling the cutting tools. The lathe is made in four sizes—16, 20, 24 and 28-inch swing.

The World's Stand-by, My Friend.

I would like to say a word in defense of a friend of mine. While there isn't anyone just directly saying hard things to him or naming him right out, yet I have a feeling that a great deal that is written does reflect on him. Action and reaction being equal and in opposite directions, while the firing is apparently away from him, the recoil or "kick' is his end of it.

I don't suppose anyone will care much for him or q it their efforts because of him, but I would like to give him a little encouragement, for I know he reads the AMERICAN MACHINIST sometimes and gets discouraged because he fancies most of those he becomes acquainted with in it are different from himself.

I say I have a friend; I should have said a number of them, and as they are rather modest fellows I will not name them, but will give enough of a description of them so that you who have met them may know who they are and understand that "there are others."

I know some of them are taking a course in a correspondence school, but I am certain it wasn't one of them that pestered our friend with the ill-written letters for a job as draftsman.

The man I am meaning is the man who knows he couldn't be President if he was to try, and isn't going to try; who thinks there are some people in the world smarter than he is; who would like to know more and earn more than he does, but doesn't know any other way to do either but by doing the best he can just where he is; who doesn't let his conceit so overpower his judgment as to make him imagine he can do all every smooth solicitor says every man who *tries* can.

As I look around I see most of the world's work is being done by my friends, and if they all had the same name and one monument would do for all, I would be proud to head the list with a good slice out of my pay envelope to get it.

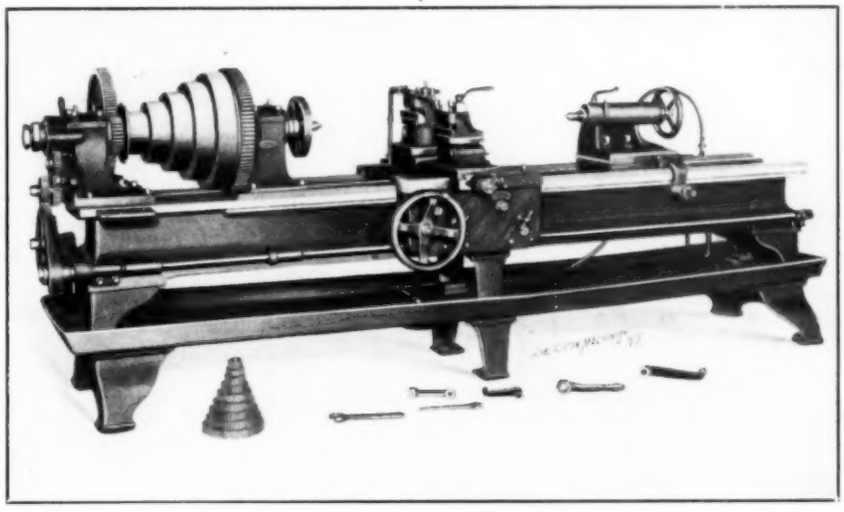
I believe there are still a few fellows who find it takes all the strength and force they can spare to do their regular work in the world. They are making a living, are not killing themselves, are reasonably content and are just as useful in the world as if they were chasing a will-o'-the-wisp and trying to be something that nature never designed them to be.

I have known pretty good horses spoiled because someone imagined they could be trained to speed when their real place was the plow.

My friend is the one man the world today cannot get along without. It is his needs we work to supply, and without him the genius would be out of a job.

As long as he gets a fair price for what he does, and does a fair amount for the price he gets and is content, I believe he is richer in the things that make life worth living than many more ambitious ones. If you desire to see him, just look around a bit. He is the *average man* in whatever calling you find him.

No, he will not try to rival the feats of Sandow when he has a development like a spring chicken, neither will he try to charm an audience like Paderewski when his best musical efforts would tend either to make a man commit suicide or murder;



SPECIAL TURNING LATHE.

and no more will you find him trying by hook or crook to attain a place where he would be entirely out of place.

If you want to see a specimen of his work, pick up the first thing your hand will reach and examine it. You will find it a good job (unless perchance you made it yourself), and the world is full of lots more just as good.

I do not believe that restless dissatisfaction is a virtue a bit more than I believe that quiet content is a vice, nor do I believe that the man who earns the most dollars, or gets the biggest shop, or bosses the most men, is, because of that, rounding out his existence in the fullest manner.

Those of my friends that I come in closest contact with work in machine shops, foundries and so forth, and I am always ready to give any of them a boost to a higher plane whenever the opportunity offers; but when one of them begins to think he can fly, I am not going to work the spring pole that throws him into the air. The tumble that follows is apt to knock more than the conceit out of him. Climbing always leaves some kind of a footing under one, while jumping into space or over a precipice isn't exactly flying.

I know quite a number of young men fancy that buying books or scholarships will make mechanical engineers of them. It will, just like buying calipers and a scale will make machinists of them. These things are all only tools and valuable only if you have skill and training to use them. If all the boys understood this there would be fewer of them getting gold bricks in buying them.

I once heard a man who employed many men say he wished they were all wanting to be at the head of the business and to get the superintendent's job. My own observation since that has been that the man who was working for someone else's job was more likely to let someone who was not working for it get his own job.

W. OSBORNE.

Boring and Tapping Machine.

Baker Brothers., of Toledo, Ohio, have brought out a machine for heavy boring and tapping. This machine is shown in Figs. 1 and 2. It is designed for drilling, counterboring and facing heavy steel forgings and castings where a large quantity of metal is to be removed, and for tapping steam and gas pipe fittings from 2 to 16 inches in diameter. This machine will drill a 4-inch hole in solid steel, using a feed as heavy as the drill will stand, and by a series of operations a hole can be enlarged to any diameter up to 14 inches.

The main spindle, which is fitted with roller thrust bearings, and counterbalanced by a weight inside of the frame, has a powerful drive. The large spur gear mounted at the top of the machine and driven from the cone pulley shaft, carries a pair of brackets planed out inside to form a guide for the cross bar which drives the spindle. This cross bar is secured to the upper end of the spindle and can be adjusted to suit the position of the spindle in the head.

It will be seen that with this method of driving there is much less friction than there would be were the spindle driven by a feather in the hub of the gear.

The machine has a belt-driven feed, lever and hand-wheel feeds, and an automatic stop and quick return for the spindle. There is also a gear feed to be used when tapping.

By changing one gear any lead from 4 to 14 can be obtained. The gear, belt and hand feeds are all clearly shown in the half-tones. At the side of the machine in Fig. 2 is shown an automatic device which reverses the spindle when the tap has reached the desired depth, feeds the tap out of the work and stops the machine. The work table, which is raised and lowered by a screw fitted with ball bearings, is planed true on the bottom, and can, if so desired, rest squarely on the bed plate as shown in Fig. 1.

There are twelve changes of speed for the main spindle, and a compound feeding device makes it possible to get six changes of feed for each speed. This is in addition to the gear feeds for tapping. The machine is furnished with oil pump, tank and all necessary piping. Another style of this machine is made for drilling and boring; the geared feed and the tapping attachments being left off.

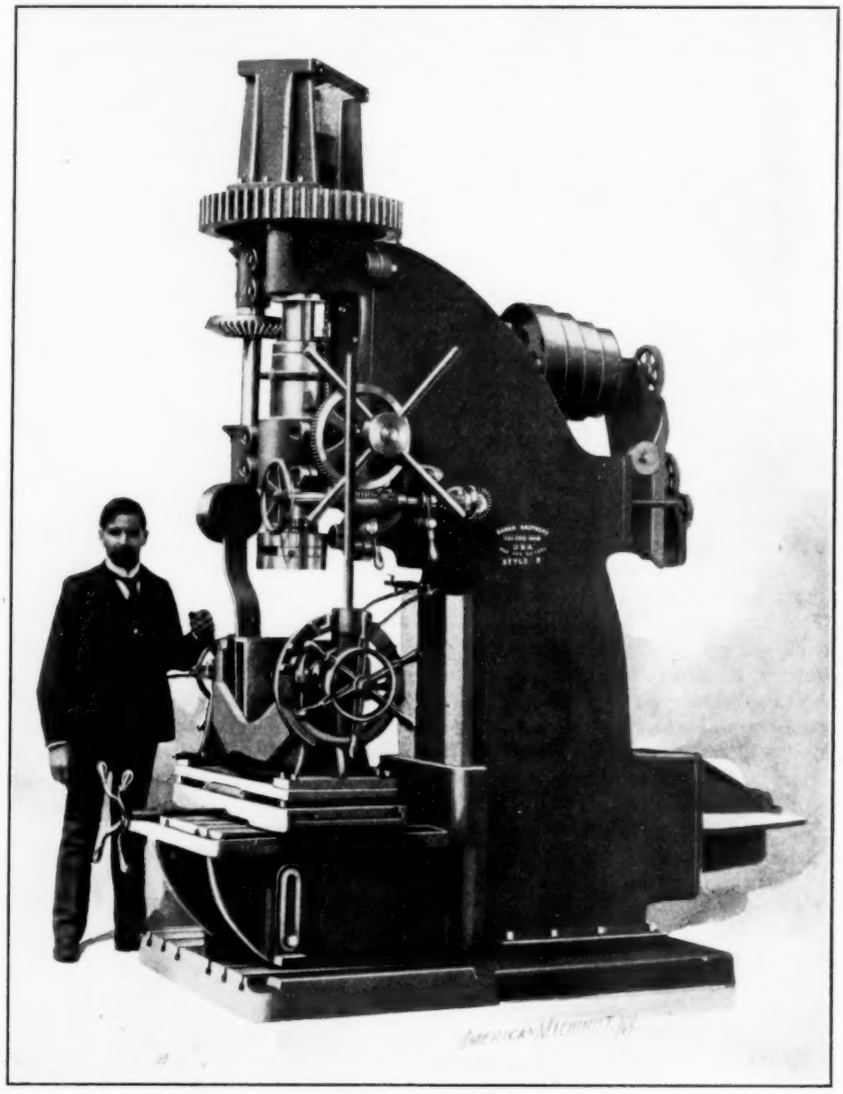


FIG. 1. BORING AND TAPPING MACHINE.

Compensation of Skilled Labor.*

The author has spent more than twenty-five years of his life in organized works; is himself a practical workman in various branches of mechanical art, both in metal and wood work, and more than twenty years of this time he was foreman, manager and owner of works, in direct contact with skilled men, directing their work and arranging compensation for the same. This experience, under various systems of paying wages, has produced the views to be presented in this paper. The last year of my shop experience was in England,

* Abstract of a paper, by John Richards, read before the Technical Society of the Pacific Coast.

under the contract system, in a company where I was a director and consulting engineer. I also acted as an arbitrator in some disputes that arose between the different departments or between the workmen and the owners.

The subject of skilled labor and wages is by no means a simple one. It is a branch of social economics that has but little useful literature. Even the word "wages" lacks logical definition. Does it mean the money compensation for workmen's time, or does it mean compensation for work accomplished? The "amount" will appear—but the rate varies with the productive power of workmen.

It does not much matter to an employer whether it requires one, two or three workmen to produce a given result in a given time. He can as well pay the amount of wages to three men as to one man or two men. The amount of the wages, measured by production, is the matter he is directly interested in; but to the workmen the rate is a serious matter, directly affecting their social and other conditions, because it is a measure of their personal compensation.

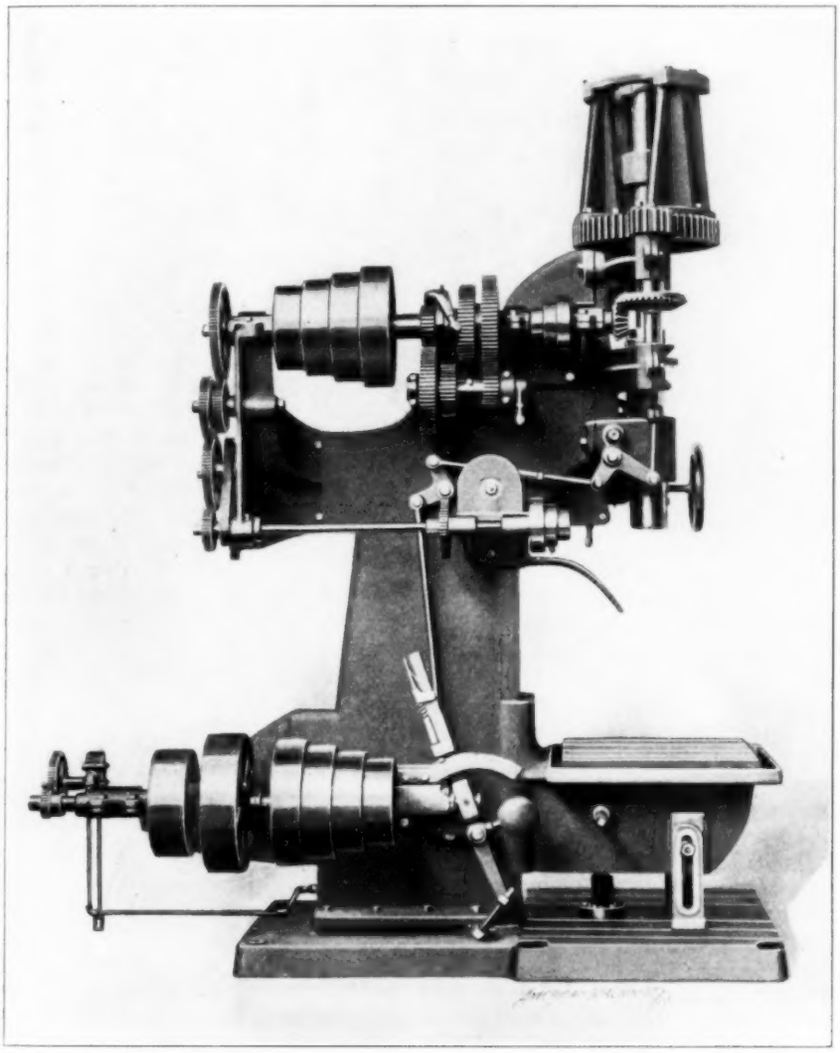


FIG. 2. BORING AND TAPPING MACHINE.

of wages, or compensation for work accomplished, is the labor cost that enters into commodities, and constitutes the real economic problem, the one that directly affects our industries and determines their success. The "rate" of wages, or compensation for workmen's time, is a social rather than an economic problem, dealing with the intellect and skill of workmen, their ingenuity and power of producing; consequently it affects directly the workmen themselves. The amount of wages is very uniform the world over when measured by product—indeed, must be so, as

The first attempt in this country to distinguish between "rate" and the "amount" of wages was made about 1887, when Mr. Schoenhof, of Paterson, N. J., was sent abroad to investigate into the "amount of wages" or the labor cost of commodities in Europe. The facts gathered by him can be found in the Consular Reports of 1888. I myself had something to do with this matter. In 1886 the late Thomas G. Shearman, of New York, came to the works in England to ascertain something concerning wages, and was amazed when I told him the wages could not be ascertained by the usual means, at least by the pay roll, because the work was contracted.

To arrive at the first stage of a practical application of this theory of wages, the following postulates will be assumed:

1. The costs of manufactured articles of every kind are made up of four elements or components, namely—material, wages, expense and profit.

2. All staple articles of manufacture, such as enter into the world's trade, must have a nearly uniform or international value.

3. The amount of wages, entering into the cost of manufactured commodities, is also nearly uniform, and must be so, irrespective of the *rate* of wages paid for their production.

4. The rate of wages depends upon what workmen produce, or upon the efficiency of their labor, and to some extent on artificial values.

5. Fluctuations in the rate of wages are commonly a result of demand and supply.

6. The amount of wages that can be paid to produce a commodity is not an accident, but is the result of fixed commercial laws of general operation, and upon the relation to other components.

Briefly expanding some of these postulates, the first one, relating to components, is merely an axiom, capable of proof by simple accounts. Profit, as a component, is just as essential as material, labor or expense. Without profit no industry can be carried on, and when the amount of profit is declared or known and is reasonable, it never leads to discontent or labor disturbances. A man so obtuse as not to know that profit is an essential component cannot be an intelligent mechanic.

The second postulate is also an axiom. Machinery, cotton cloth or any other commodity cannot have a difference of price in different markets except as affected by local taxes. For staple products of all kinds there is a "world's" price, which can vary within narrow limits only, and the range between these is constantly becoming narrower, as the price of commodities becomes more fixed in the neutral markets of the world; so obviously must the sum or value of the components be fixed. The aggregate must come out the same. If the cost of one component is raised, that of the other components must be lowered accordingly; and as material, expense and profit are approximately uniform, or should be, so also must the *amount* of wages be, but not the *rate* of wages. This may vary in any degree without disturbing the balance of components. The amount of wages in a watch must be the same in Waltham as it is in Geneva, although the rate of wages paid to workmen be as four to one, as was the case twenty years ago. The watches made in these places met and were sold in London and had to conform to a general price.

When the balance of these several components—material, labor, expense and

profit—is lost, and their aggregate exceeds what we may call the general or world's value of the product, then the industry affected must either die or be moved to a new environment. Industry follows the line of least resistance, especially in these times when powerful combinations are indifferent to localities and when local or empirical skill has nearly disappeared in our industries.

I mentioned a general or world's value of products. We are all the time coming nearer to such a standard for common commodities, and the fallacy of the demand and, in the same degree, the supply theory is becoming apparent. All commodities, including wages, have a natural value, measured by the cost of their production, and it seems strange that anyone should think so important a matter as the general rate of wages could be governed by so transient a cause as demand and supply. It is, in fact, assuming that the rate of wages is an accident and not the result of a fixed law of exchanges, as has been pointed out. The fluctuations of the labor rate are undoubtedly affected, if not produced, by demand and supply; but to contend that the general rate of wages in any country is thus produced or governed shows scant acquaintance with the subject. There is nothing to hinder skilled labor from flowing to any point where it is scarce, and, therefore, better paid. Wages may rise for a time when there is a sudden demand for some product and a want of labor at some particular place; but this lasts only until workmen can move to that place and wages soon settle down to the normal rate.

I will now revert to the circumstances of employment, or the conditions under which personal service is rendered.

1. In the scale of personal service is slavery, where workmen are not responsible.

2. Time service, in which workmen are partially responsible.

3. Piece work, where a workman is responsible for his own work alone.

4. Contract work, where a whole working force is collectively responsible.

Now these four methods or systems of service have the several degrees of responsibility named; that is, from all to nothing. *Responsibility is the key to efficient skilled service.* It forms the distinction between free and slave labor and the incentive of effort.

In respect to slavery, that no longer exists in any country where skilled industry is extensively carried on, and we need to refer to it only in illustration. A slave is not responsible for the product of his labor. That may vary more or less in proportion to what a master gives in return; but personally a slave is not responsible because he is not a free agent. Emulation, respect and a sense of duty may in a limited degree enter into his incentives; but the subordination of his will and the fear of punishment are the main causes that enforce his service.

Time work, wherein the workman is paid for a term of service, is still the most common form of employment. It stands next to slavery—not very near to it, perhaps, but next in the scale toward responsibility—and is practicable only because of the sense of personal honor and of justice due to the degree of self-respect existing among skilled workmen. Under this system workmen are responsible so far as their sense of manhood and emulative pride produce responsibility, but no farther. A man is hired by the hour, day, week or month; but the terms are indeterminate. His wages are merely a rate. If he spoils his work or fails to render such service as common custom demands, he can be discharged and nothing more. The conditions of his engagement do not make him responsible. If he spoils work or fails by incompetence to earn his wages and a profit for his employer, it makes no difference; the law will give him his wages irrespective of everything but willful negligence and the malicious destruction of his employer's property.

The results attained by a time system in this country are certainly a compliment to the integrity and good faith of the skilled workmen of our time. Contrast it, for example, with the usages of common trading. If exchanges were to the same extent based solely on good faith and manly honor, would a like result follow? I am not claiming that faithful service is always rendered from honorable and unselfish motives. The penalty of discharge is always present, and the sentiments engendered by unions or trade organizations are often independent of an employer's interests, so that we can only wonder that the circumstances are not worse, when the time rate manner of compensating skilled service is considered.

The extent to which time work is used in skilled industries may be cited as an argument for its necessity; but it is not universal, and is constantly becoming less. Greater progress would long ago have been made toward a better system had it not been for efforts that have been made toward paternal systems, such as "profit sharing." These efforts, made in most cases by earnest and philanthropic men, have nevertheless failed to meet the real causes that lie at the bottom of labor dissension.

Such a statement as this needs some defense, but one may ask, what have workmen to do with profits not earned directly by their efforts and skill? Only a part of the profits in an estaablishment are thus earned. The profits depend on many things beside faithful and efficient labor, and, if profits not earned by labor are divided with workmen, it is a gift or bribe that destroys their independence and responsibility. The better class of skilled workmen of our day do not want such favors. This sort of patronage, especially when it takes the form of free gifts, is especially provocative of discontent and dissension indicating, as it does, class distinction and an unfair distribution of profits. What workmen want and need is justice, fair dealing and responsibility for what they themselves perform and produce, and above all to learn what part this is. They have as much reason to risk their labor as an employer has to risk his capital, service, management and implements, and what is wanted is to segregate the labor component and let it rest upon its own responsibilty, do away with premiums, and, so far as possible, with a time system of service. It is degrading in the skilled industries of our time, and, while it cannot be at once removed, a beginning can be made, and above all we can study its nature and effects in the labor problems now convulsing the industrial interests of the country.

When in Switzerland, last year, I visited the works of Messrs. Sulzer Brothers, at Wintherthur, where 3,500 men are employed in machine making. There was a large building, called a Casino, containing a library, dining hall, bath rooms for hot, cold and Russian baths, a fully equipped surgery, etc. The cost of this building could not have been less than $100,000 and I said to Mr. Henry Sulzer, senior member of the firm. "This Casino is a great concession to your workmen, for which they are no doubt very grateful." His answer was: "We did not give the Casino to the men. It is an essential part of the works, built out of earnings, and belongs to the workmen as much as to the firm. They manage it. It is a community property." "But," said I, "the profits to build the Casino were deducted from those of the firm." "Not at all," said he, "we had our share."

The piece-work system, by which is meant personal contracts with particular workmen—a mixed system, in which a part of the working force is made responsible and the rest are employed on the time method, is a bad system in many ways, for many reasons. In the first place it is discriminating and unequal; and, secondly, there is no impartial standard from which prices can be determined. The price is a matter of chance, depending on the choice or conscience of the employer. It is a "provincial idea," so to speak, and is a crude effort toward a contract system. It increases the responsibility of workmen without adding much to their independence. It does not succeed unless very carefully adjusted.

We are well aware of the extent to which it has been carried out in various shops, especially in New England; but if one will look into the matter carefully, it will be found that, wherever successful, there have been a very high class of workmen and some features of a contract sys-

tem involved that modified discrimination among the men, and that rates were not fixed by accident or independently in each shop, but by rules that have been generally established by custom in a district.

The next system of service, if that term applies, is what has been called the contract system, or, as we may call it, the responsible system, in which labor is set off as an independent element in production. To make clear what is meant by a contract system of labor, the best way will be to illustrate by an assumed example; and, as one class of manufactures is as good as another, a joiner works will answer the purpose.

In a factory of this kind are prepared all kinds of timber, house-furnishing material, such as flooring, ceiling, doors, sash frames, moldings and so on. All these things have regular prices, because made very uniform for average houses, and there are price lists published that apply over wide districts. Suppose, then, that a joiner works is to be established, and that the owners, instead of hiring men by time to do the work, establish a contract system for the labor. The men are employed as in any other case, and are permitted to draw, in proportion to their rank and skill, a certain amount of money each week in proportion to the usual wages paid in such establishments; but the work, as a whole, is all contracted to the men, or to the shop, as we would say, and whatever money is advanced for wages is deducted *pro rata* from the labor estimates due at the end of the week or month for work turned out. The men being apprised of, or already knowing, the rate for making standard work, no difficulty would arise from this, and all irregular or special work would have to be estimated and include the element of labor. That amount could be posted in the works, or entered in a book kept by the foreman and accessible to the workmen. Each man would, as is the present custom, enter, each day, on his time card, the number of hours engaged on different jobs, which would, as is also the custom in most places, have a catalog or order number that would be entered on the tickets, with the time given to each number or order.

The whole shop would now be working on a contract system, every man, boy and apprentice included, and at the end of a month, week or any other time convenient, the completed work could be made up and compared with the amount paid out in advances to the men. If there is a balance due them, it is divided *pro rata* among all, in proportion to their pay rate, as indicated by the weekly or daily wages on which the advances are made. If there is a deficit, the men must make it good by a corresponding reduction. All losses, by accident, carelessness or inefficiency of the men, should be made good to the firm or company, and all losses chargeable to the owners by detention, want of material or implements, or accidents due the plant, would have to be made good to the men. If a man seeking work represents himself falsely as to his skill or rank, the owners need not concern themselves about that. The men in the works will attend to that matter; because if rated above his capacity he would be imposing on all the rest and lowering their wages.

The establishment would be co-operative, divided into two departments or interests closely allied and interdependent. The workmen would have nothing to do with material, expense, profits, risks or capital, except in sustaining these as a foundation for their own part. The labor and their compensation would depend on their own efforts and skill. No foreman to watch the men would be required. They would do the watching themselves, and do it in an effective manner. Drones would be weeded out, or, what is more likely, they would be reformed, or not exist at all under such a system. The working force would be independent, interested and responsible. If a man needed assistance or favor, the whole force could extend it by giving him easy work, or in other ways. It is an ideal system, but is not an idea. On the contrary, it is a demonstrated fact.

The main ground of objection to a contract system of labor is the matter of estimates; but does anyone undertake work without an estimate, and do not such estimates include a labor component? There may be a few exceptions, but not many. This objection arises mainly from a desire to conceal the components of an estimate, and out of a system that has no fixed rate of profits. If employers have a rule of "get all you can," they should not complain if their workmen adopt a like rule. And if employers cannot provide and maintain a reasonable expense account, to be charged to product, and cannot estimate the components, including labor, they must not expect co-operative effort in their works.

In the Manchester district, and I believe over England generally, this system prevails in the machine works of the country, and the accounts for wages are nearly double as much as on the continent of Europe. In the Cornwall Iron Works, at Birmingham, there are about 6,000 workmen, and, from information given me by one of the owners and the manager some years ago, I doubt whether, among all this number, there is any mechanic paid on the time system. I once brought out from England example accounts to show how the divisions are made in the Geesley Iron Works, at Manchester, and published the matter here. Some such system is used in the Baldwin Locomotive Works, Philadelphia, where for twenty-five years, and after a great strike at that time, not a word has been heard of labor dissension. The same result will, no doubt, occur in any works where the skilled work is made free and responsible.

No one, I am sure, who has known me, will charge that I am wanting in sympathy for skilled workmen; but, if I am correctly informed, the policy of the skilled labor organizations in this country is at this time directly arrayed against the individuality and responsibility of their members, demanding that they do only time work, determine the working hours, limit the amount performed, avoid responsibility, destroy all distinctions of skill and become a homogeneous class like common unskilled laborers. I confess an ignorance of any logical reason for such a policy. I fear that, by adopting the tactics of unskilled labor, the mechanics of our time have missed an opportunity of becoming a co-operating factor in our skilled industries, assuming the responsibility of their part of the work and basing the wages demanded upon the product of the wages, looking at the "rate" instead of the "amount," and, as remarked, have lowered their calling to the rank of common labor, thereby provoking an opposition that is as serious as it is extensive.

The employers are obliged to act on the same theory, while most of them well know that the labor component in their cost account could be reduced, and the rate of wages raised 25 per cent. by a contract system in which the workmen would be free, responsible and co-operative in their efforts. I am not arguing in favor of the employers' position; I am only showing that they accept the workmen's demand and supply theory at its own valuation.

It may seem a selfish proposition to set off skilled labor as a peculiar calling. It must become so or disappear. The intellectual standard required is all the time increasing. Implements supplant empirical skill. The colleges are each year furnishing a greater share of the apprentices. In some recent visits to works in the Eastern States I was amazed to find how many of the apprentices had come from the colleges, and how rapidly such young men advanced. The natural sciences are taking the chief place in our institutions of learning, and if the skilled workman cannot conquer a place above the rank of common labor, it will be his mistake and misfortune.

Suppose, as another example of a contract system, the owner of a foundry were to assume an estimate for iron, fuel, sand expense, losses by accident, profits, and so on—data which his own books will furnish—and then contract with the workmen to produce the castings by the ton, paying a weekly wage, charging it to the labor estimate and dividing the surplus, if any, *pro rata* among all the workmen—not dividing between the workmen and the firm as the profit-sharers propose to do, but giving it to the men who earn it. Castings could be put into classes, according to weight, green or dry molds, and so on.

I can imagine no impediment to such an arrangement, except a want of confidence between employers and workmen; and, if confidence is wanting, we are in a bad

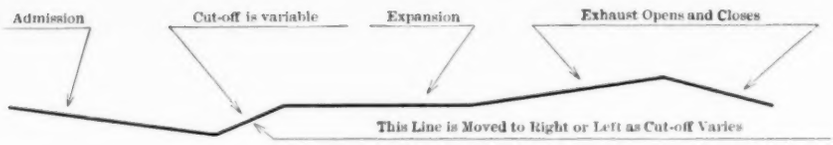
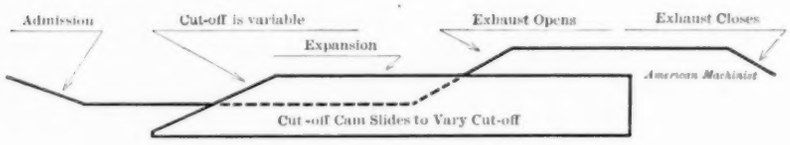


Diagram of Valve Movement of Corliss Engines.



Outline of Rhodes' Cams, or a Diagram of Valve Movement.

FIG. 1. DIAGRAM OF VALVE MOVEMENTS.

condition indeed. I have acted as arbitrator in settling disputed points in such a system, and have found no trouble whatever. If tackle broke, or if losses occurred, by accident partly the fault of owners and partly of workmen, or if faulty castings were made, such things were adjusted without difficulty; and I must add that in no case were there any unreasonable demands on the part of the workmen, who became, in effect, co-partners in the business, and relieved the owners of many details of management and of expenses attending on time work.

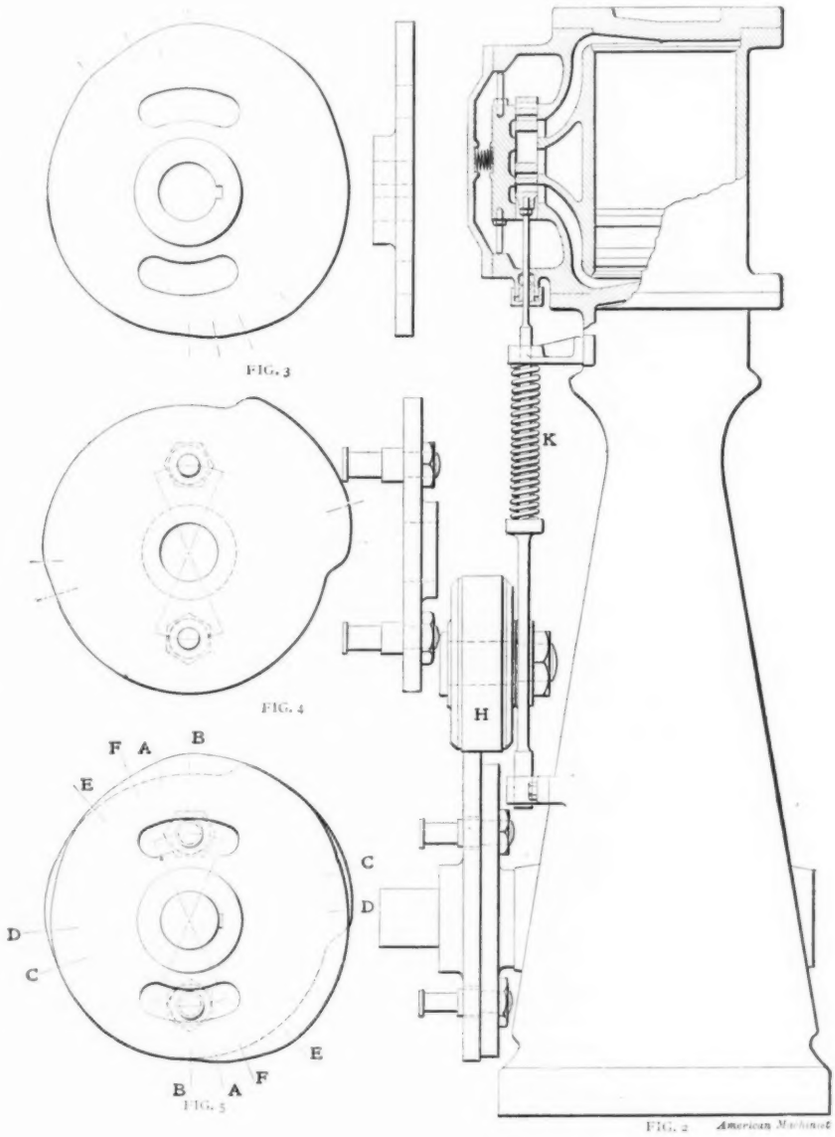
The basis on which contract work must rest is an inflexible honesty in accounts and in all other matters; and, unless this component is present, there is distrust, and the co-operative idea cannot be put in practice. Under a contract system I have no doubt that the product of a certain amount of wages would, in most cases, be increased 25 to 50 per cent. over what time wages would produce, and there would be no grounds for strikes and contention, when custom had established prices, and this would soon follow.

High Speed Engine.

The drawings shown herewith represent what the inventor calls a high-speed Corliss engine. It is doubtful if an engine having but one valve, using the same port for induction and eduction, and the valve seating upon the back as well as the face, can properly be called a Corliss engine. At the same time it has features very distinctive from those of the ordinary high-speed engine, and the steam distribution is the same as that of the Corliss engine. This is most readily seen from a comparison of the diagrams, Fig. 1. The valve, which is of the balanced gridiron type, is operated by a raw-hide roller *H*, secured to the valve stem and receiving its motion from a cam on the main shaft, the roller being held to the cam by steam pressure and the spring *K*. The main cam is shown in detail in Fig. 3, the supplementary cam for controlling cut-off, in Fig. 4. These cams are assembled as in Figs. 2 and 5, their relative positions being under the control of a shaft governor (not shown) of the usual construction. At *A* the valve begins to open to admission; at *B* it is wide open and stationary, remaining so until *C* is reached, when it begins to close. At *D* the closure is complete, and with a slight further movement to secure the lap, the valve rests until nearly time for compression in the opposite end of the cylinder. At *E* compression begins in the opposite end of the cylinder, and at *F* the valve begins to open to exhaust.

The opening and closing movements are very rapid, and all the events, except cut-off, take place at constant points in the piston travel. Cut-off can take place at any point between three-eighths and five-eighths stroke. The valve travel is constant, regardless of point of cut-off; a full port opening is always obtained, and the distribution is the same as that of a four-valve engine. The cams being of a large diameter, their rises are easy for a given valve movement. A 3x4-inch engine fitted with cams like those shown has been run at 500 turns per minute, and has proven to be practical, positive in action and quiet in operation. It is of course not limited in speed as the Corliss valve motion is.

The inventor is A. Edward Rhodes, formerly chief draftsman the J. Morton Poole Company, Wilmington, Del.



HIGH-SPEED ENGINE.

Echoes from the Oil Country.

GETTING WORK IN HARD TIMES.

It is not always the easiest thing imaginable to know when a thing is as good as it pays to make it; and, on the other hand, it is not always clear when a thing is so bad that it should be repaired, although it is not hard to find examples that show that the mark has not been hit in either case.

One of the ways a job shop has of making work is to take jobs on a guaranteed saving, and this can often be done where the owner feels entirely too poor to have anything done. In one case a man had a steam engine, the exhaust of which was giving sure evidence of the condition of the valve, and an offer of $5 was made to set things right. An hour's work earned that $5 and also the admiration of the engine owner.

A near neighbor had an engine with a good job indicated by the exhaust, and full general repairs were offered for the saving in coal for six months and the job to be rushed through. There was no contract signed, we were only looking for work. The engine had been used only a few days after being repaired, when the owner came in and paid the bill in full and then told us the saving in coal amounted to a carload a month. Of course, he was willing to pay the bill.

It took some talking to show another man that a piston head 1-16 inch loose and a set of rings stuck fast, so as to make a practically solid head, was what made his boiler so hard to fire. Those rings (the old style three-ring packing) had evidently never been set out, as the follower bolts were rusted fast and all twisted off instead of unscrewing.

I kept an engine slide valve for a long time to show as a horrible example of how bad things could be and still run. This valve came in with a cylinder from a saw-mill engine and they "had an idea it needed a bit of fixing." So had I after seeing it. When the valve was laid central on the seat it left the ports partly open at each end, enough of the valve being broken away to leave about one quarter of the full opening at each end when they were as nearly closed as they could be at the same time. A straight-edge laid across the seat showed it hollow in the center a full 3/8 inch in the worst places and full of various ridges and streaks. The valve was worn to a thin edge and this edge breaking off had shortened the valve to where I found it. In its general shape it conformed quite well to the seat, it also being rounded and streaked. I would have been willing to venture that it would have been impossible to run the engine without load even, yet they had been running a saw-mill with it.

"You bet it took some firing, but that didn't matter; fuel don't cost anything around a saw-mill and we have a great big boiler," said one of the men that came in with it. "It's a wonder you brought it in," I said. "Wouldn't it do your work any longer?" "Oh, we could run with it right along; it would pull the big saw when nothing else was on. That wasn't the trouble: we couldn't get water into the boiler fast enough to make what steam we needed. The injector throws an inch stream, but didn't begin to be enough, and every once in a while we had to stop to run the water up in the boiler; that got so bad we either had to get a bigger injector or get the engine fixed and we thought it would be cheaper to get the engine fixed." A new valve and a false seat fixed them up. They didn't want the cylinder bored, and I thought it a waste, too, with such good firemen and cheap fuel.

That engine on the hill was a little different. It never had run entirely satisfactorily and had passed through several hands, all of the time doing less work than others of the same size and make, until it was looked on as something of a "Jonah" by those who knew it, and it had quite an acquaintance. One more well hung on was the straw that broke the camel's back in this case, and something had to be done. As machinists had at various times been to see it when it had proved too weak for former owners, this one did not have the abounding faith in us that all intelligent men should have had, and he was at a loss just what to do. An offer of a first-class job for $25, a guarantee to pull his load with no pay in case of failure and we to pay him for hauling it in and out, brought the engine to the shop.

A materialistic turn of mind and an experience with a good many old machines had confirmed the belief that every effect has a cause, the only question being, "what is it and how can it be changed?" So the engine was taken completely apart.

After the cylinder was taken off the bed and rolled over, anyone could see the fin that closed two-thirds of the exhaust opening, and a few minutes fixed that "Jonah" and went a long way toward earning the $25 which a few minor repairs completed, and the engine ran to the entire satisfaction of the owner.

Some people that build engines seem to follow theories which, while good in themselves and all right when used as they should be, are used in a way that helps us to an occasional job. The man that built the engine at the meat market knew that compression was a good thing, but he evidently didn't know exactly how much was good and likely thought that if a little was good more was better, just like wages. The owner of the engine thought a new boiler was indicated, and was surprised at the gall of the machinist (whose opinion was asked as to the proper size to get to suit the engine) when told that the boiler was big enough if he only had a decent engine.

"Why, my, O! that engine has been running for five years and never cost a cent for repairs, but now we got so many hogs to make into sausage and so many old tough cows to work into bologna that the boiler won't furnish steam enough."

"It's a good thing there is such a big profit in the butcher business or the fuel bill would ruin you. There is a pile of money going out of the exhaust there, and you fellows are not smart enough to see it. As you bought the engine from the other fellow it was not our picnic. Now I suppose you will put up the price of meat if you have to get a new boiler, and as I eat meat I would rather fix your engine for $5, and will make it make your old sausage machine hum better than it ever did."

Some fellows like to talk, and this fellow must be shut up, so the money was produced and paid over in the presence of the meat gang and the boss had to have that engine fixed or squeal.

He directed me to cut out the inside lap when he brought the valve to me, and I was surprised to find out how much there was. It was about the same as the outside lap and looked as though the builder had tried to save *all* of the steam.

In a very short time that engine had hold of the meat cutter again, it in the meantime having been loaded in a way that meant being stalled before, and on the word being given to "let her do all she will," things began to go at such a rate that the men ran for the door and stayed out until it was slowed down. They fired with natural gas, and I notice they now can do their work without the gas coming out all around the door and showing from the top of the smokestack.

You see, I once knew a boiler that was fired that way. I had to go by it going to and from work, and I never had time or inclination to loaf around there. I was glad it was set broadside to the road as I thought the hot water might not travel so far sideways, and the solid material was a little more prone to go endways when it made up its mind that the conditions were unbearable and struck. I was in sympathy with the oppressed, but dreaded the effect on the innocent public. Perhaps it was my duty to offer my services to make things better, but I was timid about doing so. I had once been called in by the owner on a little matter of machinery and had been sat down on quite heavily because my opinion and advice did not agree with his ideas. He was a haughty man who seemed to think that a machine should be awed by his presence just as his men were.

I like machines because they are so discerning in their likes and dislikes, and know their true friends. When he found that this one insisted on doing as I said it would, he promptly sent it out of town for repairs instead of to our shop, so you

will understand I did not consider it my duty to do more than spend as little time as possible near his place. One morning the boiler was gone and a building near by had a hole through it large enough to drive a team through, and I have the memory of that hole in my mind whenever I see a boiler with the fire spreading out around the door and up the stack.

W. OSBORNE.

Jig for Drilling Rough Castings in Pairs—Jig for Drilling and Countersinking.

BY JOSEPH V. WOODWORTH.

Fig. 2 shows two views of a drill jig, with work in position, for drilling holes in the tops of rough pairs of bracket castings. These castings were used in large numbers and were of the shape shown in Fig. 1. The three holes in the body portion were cored, and, as the pairs were not machined at any point before drilling, the holes were used as locating points in the jig. The jig consists of a body casting in the shape of an inverted "T," *X* being the base and *G* the upright which supports the plate *E* and the work. The work is located in pairs on either side of the upright by the dowel pins *D D D*, which enter the cored holes, and held by the clamping device, a cross-section of which is shown in Fig. 3. This clamp is of tool steel, with wings at *I* and *J* to swing over and clamp the work, the center portion *L* being turned to fit the semicircular bottom of the slot in the upright *G*. A plate *H* is let into and fastened to the front of the upright *G* by the two screws *N N*. This plate has a stud *M* fastened in the center of it in line with the circular portion *L* of the swivel clamp. The face of the stud is finished to the same radius as the portion *L*, and is of a length sufficient to allow of the face acting as a back bearing for the swivel clamp to swing on. This construction allowed of making the clamp in one piece, and gave better results than if one of the wings had been made separate. About 3-32 inch clearance was given lengthwise to the circular portion *L*, for rapid fastening and releasing when in operation. The plate *E* serves as bushing plate and bushings as well. It is of tool steel with three holes at each side as guides when drilling the holes *A A A*. The holes *C C C* are countersunk to allow a ready entrance for the drill. The plate is hardened and drawn slightly, after which it is ground on both sides and the holes are lapped if tight. The plate is located on the body casting by two flat-head screws *F* and two dowel-pins not shown.

When the jig is in use the clamping device is swung out of the way and a pair of castings are located on the jig, the dowel-pins *D D D* being made an easy fit in the cored holes. The swivel clamp is then swung back and the screw *K* is tightened against the castings, thus fastening the work against the sides of the upright *G*. The six holes are then drilled. This jig allows of the drilling being accomplished to the required degree of accuracy and interchangeability and in a very rapid manner. The swivel clamp, for fastening the castings against the rib sides, can be adapted to advantage for locating and fastening work of a variety of different shapes, whether the parts are sent to the jigs rough or first machined at different points.

The jig shown in Fig. 5 is used for drilling and countersinking the hole *D* in the casting, Fig. 4. The castings before being drilled are bored at *A*, to a diameter of 1¼ inches, and the hub is faced at *b b*. The hole *D* is required to be central with the rib *C*. The parts comprised in the jig are: the body casting, with a circular portion at *E*, a base at *P* and two feet at *R R*; the bushing *G*, and the locating and fastening device *J*, *I*, *L*, *K* and *N*. The portion *E* is bored at the front slightly larger than the hub of the work, and is faced at the back for the nut *N*. The bushing *G* is hardened and ground, and forced into the top. It is lapped to fit a combination drill and countersink. The locating and fastening device consists of a machine steel stud with the nut *N* and turned at *K* to fit a reamed hole in *E*, and at *F* to fit the bored hole in the casting. A half-round groove is let in at *L* as clearance for the drill. A large head at *J* and a washer *I* with a section cut out at *M M* complete it. The work is located on the jig so that the hole when drilled will be central with the rib *C* by entering the rib into a slot at *O*. A slot is let in at *Q* in the base as clearance for the end of the work.

When in use the washer *I* is slipped off the locating stud and a casting is located. The washer is then slipped over the neck of the stud and the nut *N* is tightened. The hole *D* in the work is then drilled and countersunk. To remove the work all that is required is to loosen the nut *N* a bit, and slip off the washer.

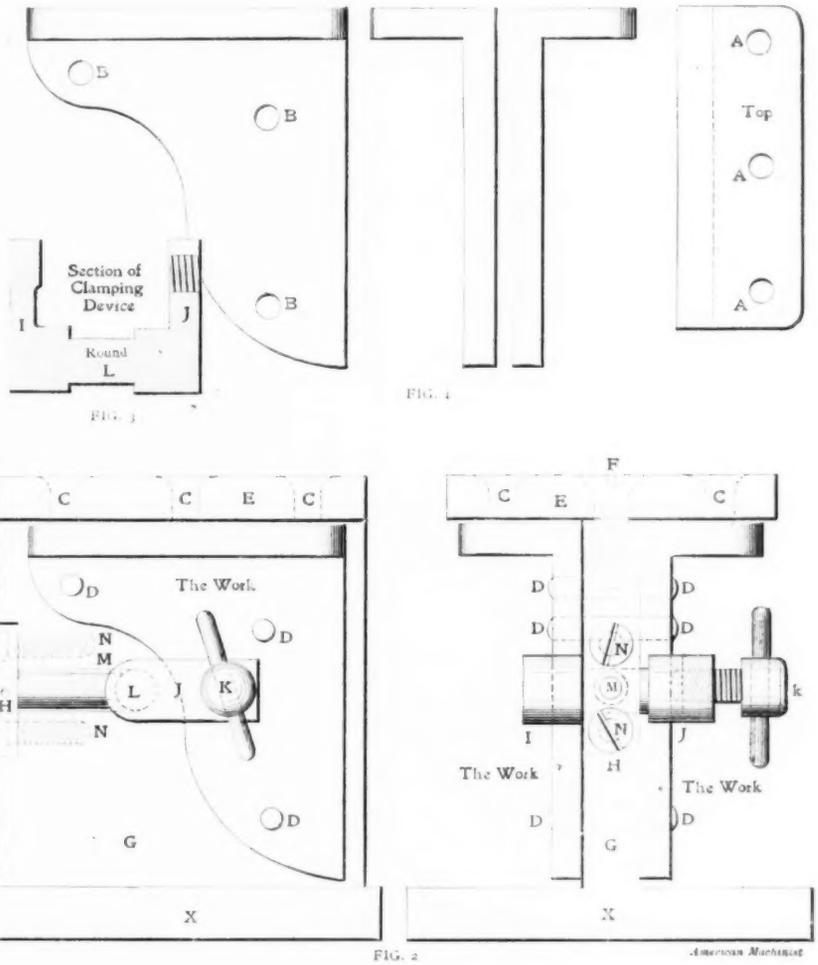


FIG. 3 FIG. 4 FIG. 2

American Machinist

JIG FOR DRILLING CASTINGS IN PAIRS.

These jigs should be suggestive for the rapid and accurate production of different shaped repetition parts which are to be drilled. One thing which should always be kept in mind when designing or constructing fixtures for interchangeable production is this: The fixtures used for rough or simple shaped castings should, if anything, be produced quicker and cheaper than those for machined or perfectly interchangeable ones, because castings of the first type are, as a rule, sold at such a low cost that unless they are produced very rapidly no profit is possible.

Alcohol Motor Wagons in Germany.

United States Consul Frank H. Mason, sends from Berlin an interesting account of the progress of alcohol motors in Germany. The government of Germany is trying to promote the use of alcohol for industrial purposes, including lighting, heating, and power generation. On April 1 it offered prizes of 10,000, 5,000 and 2,000 marks ($2,380, $1,190 and $476), respectively, for the best "Vorspannmaschine," or draft wagon, with alcohol motor. These prizes are to hasten and bring out in completed form the several types of spirit-motor vehicles for military and general purposes.

The specifications provide for a machine which shall weigh, when equipped, supplied and manned in working order, not to exceed 7,500 kilograms (15,750 pounds), and the heaviest laden axle shall not carry, when in service, more than 5,000 kilograms (11,023 pounds). The machines shall be able to run on good roads, having nowhere a more abrupt ascent than 1 in 10, at an average speed of 5 kilometers (3.1 miles) per hour, or 70 kilometers (43.5)miles) per day, and to haul under the same conditions another vehicle or vehicles weighing up to 15,000 kilograms (31,500 pounds). The machine shall carry a supply of spirits, oil and all other materials sufficient for a run of two days without replenishing. When running alone without trailing vehicle, the machine must be able to ascend a grade of 1 in 5. It must be able to travel over all roads that are practicable for loaded wagons drawn by horses or oxen, and to traverse fields, meadows and ordinary farm lanes, or to ford streams or ponds in which the water does not exceed 40 centimeters (16 inches) in depth. It must run backward as well as forward, be able to make on occasion of necessity 8 kilometers (about 5 miles) per hour when running forward or 3 kilometers (1.8 miles) per hour backward. The machine must be provided with two independent brakes, one of which will automatically act to prevent retrograde movement when the vehicle stops in ascending a grade. The construction must be such that the driver can start, reverse or control the direction of the machine or oil its principal bearings without descending to the ground. All working joints, axles and journals must be protected against mud and dust, and all parts of the machine must be susceptible of being made standard and interchangeable in the event that either prize-winning model shall be accepted by government for military or other uses. The driving wheels shall have a diameter of not less than 1.6 meters (63 inches) nor more than 2 meters (80 inches); the tires, a tread of 16 to 18 inches in width. The hight of the fixed portions of the machine above the road level shall not exceed 250 centimeters (8 feet 3 inches); the width, 215 centimeters (7 feet 1 inch; length, 600 centimeters (19 feet 9 inches); and the length of wheel tread, not over 350 centimeters (11 feet 5.8 inches).

The motor must be able to use crude alcohol without admixture of any other material, or, on the other hand, to use alcohol mixed with benzine or other product of petroleum, without injury to the working parts of the machine, and must be provided with igniting apparatus of the best modern type. All tanks which carry inflammable material must be equipped with safety cocks that will avert all danger of explosion. The balance wheel, if used, must be made of steel, and so located and shielded as to offer no danger to the attendants. The machine must be able to start and run or be reversed quietly, without shock or undue noise; must be capable of running in snow or over icy, slippery or muddy roads, and be able to work continuously twenty-four hours without repair or cleaning.

France has taken a strong and successful lead in the application of alcohol motors to automobiles of various classes for travel and the lighter forms of business vehicles. Germany now follows with this definite reach toward a higher and more advanced application of the same material to the heaviest class of locomotive vehicles required for engineering, military or agricultural purposes. The whole German system of producing and using alcohol for industrial and technical purposes is worthy of the careful study of American economists.

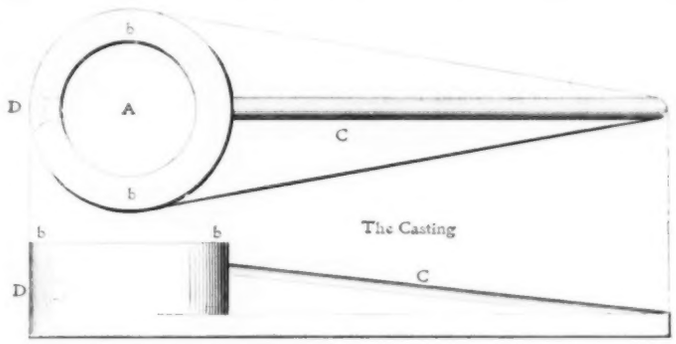


FIG. 4

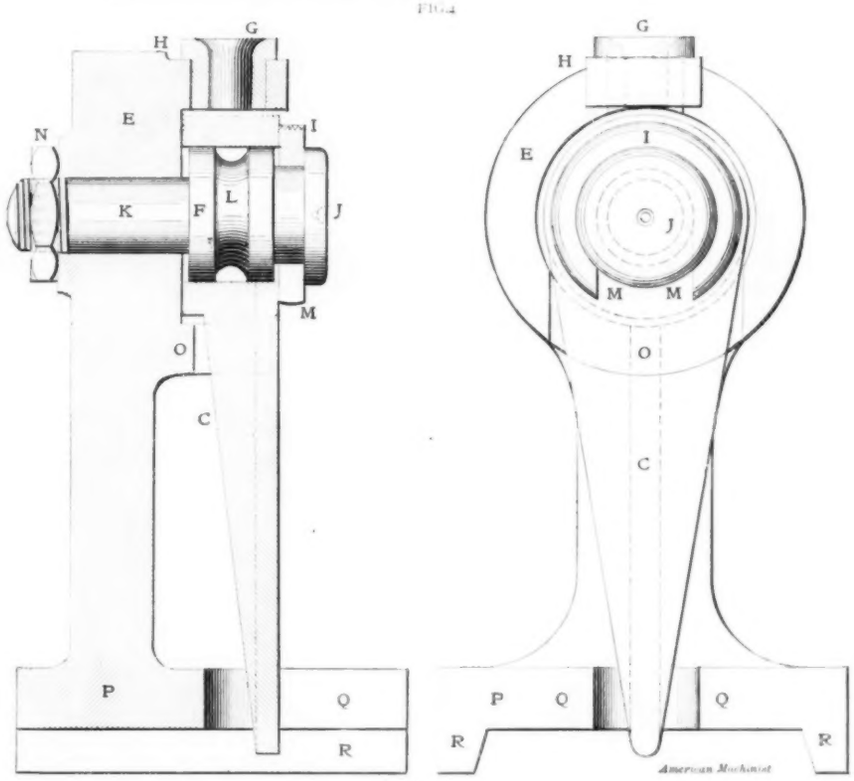


FIG. 3

JIG FOR DRILLING AND COUNTERSINKING A BORED AND FACED CASTING.

From the Note Book of a Cosmopolitan.

PLANER DRIVES. TRANSMISSION CHAINS. THE NEW STEEL.

After you get the problem of feeds for millers settled, I have some other problems in machine-tool construction that can beneficially be talked about. Will we ever see a committee in one of our engineering societies selected for the object of throwing light on certain practices in machine construction for the benefit of the new generation to come, or would it end in

bloodshed? In a recent letter from a well-known man just returned from Europe, he says:

"I have some interest but not much in machine tools. They belong to an art that has no measure of merit and no co-efficient of efficiency. Considering the best efforts of the most skilled people, they have not attained to any settled feature or standard. Indeed, shop manipulation is not the perfect thing it is assumed to be and in no works of which I have knowledge is it better than in Switzerland, all things considered."

This is perhaps a little extreme as an opinion, but there is a large amount of truth underlying the words referring to efficiency.

. . . . . .

When planing machines were in the early state of evolution, a preference was given to a screw for moving the table. This was no doubt due to a want of appliances for producing accurate racks and pinions. Or, was it due to a superior knowledge of the better planing that can be done on a table moved by a screw. It is generally known that the adoption of the large intermediate gear to work in the rack instead of placing the small pinion direct into the teeth of the rack, brought rack-driven tables into a more settled type. I believe this is essentially an American contribution to planing machine development. I mention this fact because, although this system has been in use here for a generation, there are still several prominent English makers of planers who do not know this system, and go on making planers with small pinions over which the table dances along when doing heavy work, and producing a corresponding corrugated surface on the work.

. . . . . .

But were we entirely wise in abandoning the screw for planing machines? Certainly, it is difficult for a rack-driven planer to produce the beautiful surfaces on wrought iron, with water, that can be done with the screw-driven table. I can see a tendency toward a return to screws for planers under certain conditions. At the time that racks were unsatisfactory for planers Messrs. Sellers developed their "screw-motion," and although this is classed under the heading of a worm and rack, yet it is practically, so far as the smooth motion of the table is concerned, a screw motion in effect. It imparts to the table the same kind of smooth and uniform motion that a screw does. Now it is apparent that this worm driving system for planers is growing. One maker in the West has adopted it, and the open side planer is another example. Are we traveling in a circle, and shall we get back to screw-driven planers finally and adopt more generally the screw as the smoothest and most satisfactory way of driving either planers or shapers? In England there have been a large number of shapers built with a screw motion instead of a crank or rack for moving the ram. Again, I might cite the Richards Side planer, of which more than a thousand have been made, doing a class of planing that can hardly be equaled by a rack-driven machine. Again, all plate edge planers that I know of are driven by screw. Here is something worth thinking about.

. . . . . .

Before I drop planers for the moment, I ought to mention a planer that was exhibited at the Glasgow Exhibition, which I did not see while on my visit to England last summer. It is a German machine with a table driven by a chain. I can hardly follow the arguments in favor of this, but it is evident that the makers have some serious objections to either racks and pinions, or screws, or the "Sellers" worm to go out of their way to design and build and put on the market a planer of this type. Is it evolution forward or backward? I do not remember seeing any description of this machine in your columns, Mr. Editor, and I for one of your "old and constant readers" would like to hear the pro and con of this machine.

. . . . . .

While speaking of chains, I am glad to notice that the special chains of Mr. Renold are being made here. I have followed the development of the making of chains by Mr. Renold for many years past, up to now, when his wonderful success in making hardened steel chains to replace belts may be regarded as the triumph of a master mind working continually in one direction. Mr. Renold has one of those mechanical minds which looks at everything with a magnifying glass. No detail is too small or of minor importance to him. Nothing satisfies him but what is just right. This trait may not be so unusual as to warrant being mentioned, but with Mr. Renold he does not stop until he arrives at a point of satisfaction. Of course, such men are "difficult," as the French say, and I could fill a column with examples of Mr. Renold's victories over problems in mechanical niceties called for by the extreme exactness of his chain manufacture. I recommend all of my friends who are departing for the land of fogs, to stop at Manchester and see a large factory without a single belt used to drive either the shafting, countershafts or feeds on the machines. There may be a belt hidden away somewhere, but I have not seen it. The application of a chain by Brown & Sharpe to the spindles of their vertical millers is sufficient evidence of where Mr. Renold has arrived, and yet I believe that even a better chain, with all parts hardened, is now being made, although not yet in use here. It may be mentioned for the benefit of those to whom chain driving is a novelty that it avoids tension on the bearings, and occupies less space, which is important in over-hung bearings. It is also claimed to give a perfectly uniform and of course a positive motion. Now that the chains are being made here, we shall all of us probably become chain experts more or less. In any case, I am glad to see Mr. Renold so honored.

. . . . . .

What is to become of all our patterns, drawings and expensive jigs for our machine tools? Are we on the verge of a revolution? I refer of course to the "new steel" that is going to make us "get up" as they say out West. Many of our machines have even been regarded by us here, quite aside from the constantly heard criticism of our English purchasers, as on the verge of lightness. With the demand for machines that will give a cutting speed of 50 to 100 feet per minute with a greater rate of feed, there is going to be plenty of work for draftsmen and patternmakers, and an unlimited supply of firewood for the cupola until our cherished patterns are replaced. In England and the Continent there is a "boom" on tap at present. Makers of the special steel have sprung up as if by magic. There are several in England, and French, German and Austrian steel makers have also produced this strange new material which can become hot when working without losing its temper and hardness. Specifications for new machines call for higher speeds with a large increase of power. There appears to have been but little success in getting a steel that will show such marked results on cast iron as in working wrought iron or steel, but in a recent letter I learn that Messrs. Whitworth, of Manchester, have found a steel that is equally good for cast iron. What a simple plan of "doubling the production" by simply changing the engine governor until everything in the shop hums at double the former speed! I am told that this steel has come to stay, and if so, it is simply a beginning of the revolutions predicted for this new-born twentieth century.

A New High Speed Steel.

Since the invention of the Taylor-White steel and our publication of an account of it, steel makers all over the world have been stimulated to produce a steel which can cut continuously at high speeds, and the latest addition to the list is made by the well-known steel manufacturers, Jonas & Colver, Ltd., of Sheffield, England. This concern has long been known as a maker of very high grade steel and has had a considerable trade in America. Their new steel is called "Novo Air Steel," and it hardens in air or in hot water, whichever may be preferred. In forging this steel it is heated to a higher temperature than the ordinary carbon steel—in fact, to a lemon color—but it is advisable to be particular to heat it thoroughly and evenly. It can then be worked at this high heat, and works with greater facility than most other steels, it being perfectly practicable

to draw it down to as small a size as may be desired under the steam hammer, or it can be bent at right angles. In hardening it is necessary only to hold it in a blast of air or to plunge it in hot water.

It is claimed that this steel is absolutely not liable to cracking and that it will maintain fine edges. It can be annealed in the ordinary way, and when so annealed can be worked by milling, planing, or any other of the ordinary operations of steel working, so that taps, milling cutters, reamers, or whatever may be desired, can be made of it.

We have information regarding some remarkable tests of this steel, showing that it is capable of giving very high duty. For instance, a tool 1x2 inches took a roughing cut on a shaft for a hoisting engine, the shaft being 11½ inches diameter, the cut ½ inch deep, with feeds varying from 1-32 to 1-16 and up to ⅛ inch at a speed of 93 feet per minute, the length of the cut on the shaft being 4 feet. The same tool did the finishing cut at 70 feet per minute and was in perfect condition. On cast iron one of these tools took a cut ¾ inch deep with ¼-inch feed at 35 feet per minute, the same tool taking the finishing cut at a speed of 165 feet per minute. On nickel-steel, steel castings, brass of government composition and other metals, tools made of this steel have shown their great superiority to ordinary steels so far as capacity to stand high-cutting speeds is concerned, and the steel is an interesting addition to the list of such steels. It is being introduced here by Hermann Boker & Co., of New York.

Some English Time Check Systems.

The oldest method is probably by means of the giving and return of the men's time boards as they pass the time-office window on arrival and departure. These boards being numbered consecutively, those left in the office after the gate is closed denote the men that are absent. On leaving work each man hands his board in at the time office, it being a fixed rule—no board, no pay. This method has been in use for the past fifty years or more, and is still used by some firms.

The next method to be adopted is what is now universally known as the "check system." There are several modifications of this system, the following being a very usual one: Each man on leaving work at night is given three different-shaped brass checks numbered 1, 2, 3, as well as bearing the man's distinctive number. No. 1 is given in before breakfast at the time office, No. 2 after breakfast, and No. 3 after dinner. These checks are delivered to the men by the timekeeper from a check board accessible only to him, where they hang in sequence. If a man leaves the factory without his checks, he cannot obtain them again without a satisfactory explanation. Sometimes a fourth check is used for overtime.

In both the "board" and "check" systems a time book is necessary to record the actual time each man has worked per day. This book is ruled with columns for each day of the week, and the time entered therein for each section of the day. There are various methods of doing this, some preferring to use marks of some kind instead of figures. Thus in Great Britain the day is usually divided into three sections, in which the working hours may vary at different times of the year, but the exact duration of which is always known to the timekeeper; then three strokes may be used, one for each section of the day: / for time before breakfast, \ for time after breakfast, and — for time after dinner, a complete day being represented by a triangle, thus △. Owing, however, to the difficulty of convincing the men in the case of dispute, this method is not to be recommended. Where figures are used each day the column is divided into four sections, the actual hours worked being entered therein, and the fourth section reserved for overtime.—*Mechanical World.*

The Earth and the Engineer.

"I have been told that there is in some of the illiterate mountain regions of the South and West a religious sect known as Hard-shell Baptists, one of whose tenets is that the Almighty made the world just as He wanted it, and that every change on the face thereof, even to the building of a turnpike road, is an act of disobedience to His supreme will. Tested by the tenets of that sect, the engineers must be very wicked, especially those who live and work in New England. But here again I am for the engineers and against the Hard-shell Baptists. Why was the face of the earth made so rough and irregular? Obviously, as I think, that it might call forth all the energies and efforts of man to make it fit for his home; for as he builds his home so he builds himself. Wherever the Almighty has done the most there has been the least progress of the race. Indeed, if we may credit the story of the Garden of Eden, which, as it is said, 'gave man all to live with and nothing to live for,' the first thing man did when placed in the garden was to steal apples; whereas the best and noblest of the race have been developed on those shores and in those countries where unrelenting toil was the condition of life. This fact indicates the purpose of the Almighty. Man was not made for the earth, but the earth for man, and only where his surroundings compelled the earnest struggles were developed the highest capacities of his being. Talk about the curse of labor! If Eve's curiosity drove man out of the toilless garden, I, for one, bless the old lady for it. So, despite the theory of the Hard-shell Baptists, I say thank God for the engineering spirit which bids man grapple with the broken surface of the earth and work upon it until 'every valley shall be exalted, and every mountain and hill shall be made low; and the crooked shall be made straight and the rough places plain,' for thus 'the glory of the Lord shall be revealed and all flesh shall see it together.'"—*Justice Brewer before the Boston Society of Civil Engineers.*

A "Labor Exchange" in Antwerp.

The accounts of the many enterprises which are undertaken in Europe for the ameliorating or bettering of the conditions of the wage-earning classes are always of interest to workers and thinkers on this side of the Atlantic, although many of them are impracticable and others only practicable in modified forms with us. United States Consul-General George F. Lincoln sends from Antwerp a slight account of a "federation" to protect and develop the interests of the shipping trade at Antwerp. This federation, he says, which "assures regular work for the dockers, is gradually uprooting the evils of which the working classes complain, and by arbitration is amicably settling all disputes. The workmen are guaranteed an indemnity in case of lack of work, and mutual benefit associations among the dockers are favored and, encouraged. These associations supply the members with medical aid, old-age pensions, relief to their families in the event of sudden death, etc. All these privileges are made possible by subscriptions from both employers and employed. The success of the federation has exceeded all expectations, and now over 5,000 dockers have become members. Never has there existed a more complete understanding between masters and men than under these conditions. Day work has now proved so efficacious that the necessity for overtime work has greatly diminished. The new Labor Exchange is constructed in the very heart of the Antwerp maritime district. It furnishes at cost excellent beer, coffee and tea, but no gin. At the close of work the men are also at liberty to eat their dinners at the exchange. Well-appointed lavatories are provided free of charge; also offices, where the men are paid, and a well-stocked dispensary is ready for all cases of emergency."

A curious case of carrying the power, the tools and the skill to the raw material is that of a floating button factory on the Mississippi. The buttons are made of mussel shells and these are found all along the river, but not in inexhaustible quantities anywhere. The floating factory is 42 feet long and 12 feet wide, a scow in fact, with the necessary machinery and a 3 horse-power engine. The workmen live in comfort on the boat.

According to the best calculation that can be made, the amplitude of vibration of the diaphragm of the receiver of a telephone is about one twenty-millionth of an inch.

Letters From Practical Men.

Cutting Spiral Gears in the Lathe.

Editor American Machinist:

I have been much interested in the articles on spiral gears which have been published in your columns recently, and reading them has carried me back some ten years to a time when I was asked if I

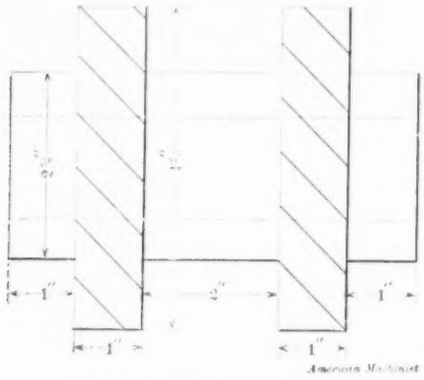


FIG. 1. SPIRAL GEAR BLANK.

could replace a pair which had become worn out after having been in constant use forty-five years operating the table of a large slotter made by Dunn, Hattersly & Co., of Manchester, England. I believe it will interest some of your readers to know how I proceeded. There being no universal milling machine in the shop, they had to be cut in the lathe. I could find no published work on spiral gears that was of any use to me. The only one I could find deprecated their use as consuming too much power.

While working in the Woolwich Arsenal, England, I had been shown, by an old turner, a method of finding change wheels to cut worms to fit worm wheels of any given diametral pitch. Never having seen this system used except by myself, I will give it, as it leads up to the cutting of the spirals mentioned.

Suppose a worm is to be cut to fit a worm wheel of 10 diametral pitch, the lead screw of the lathe having, say, 2 threads per inch. Multiply the diametral pitch desired by 7 for the driven, and the number of threads per inch of the lead screw by 22 for the driving gear; that is:

Diametral pitch $10 \times 7 = 70$, the number of teeth of the driven gear.

Lead screw pitch $2 \times 22 = 44$, the number of teeth of the driving gear.

Compounding these gears gives:

$$\frac{44}{70} = \frac{11 \times 4}{10 \times 7} = \frac{110}{100} \times \frac{40}{70}$$

the gears required.

The spirals which were to be cut were to be of brass, to be of 5 diametral pitch, to have 20 teeth and to work at right angles, both being of the same size. At this time I knew nothing about helixes, circumferential pitches, etc., etc., at least not by those names. I got a casting made like Fig. 1, the two wheels being on the one piece. I turned the blanks to the proper diameter for that pitch and figured for the change wheels, using the method I have explained for cutting worms.

The lead screw of the lathe had two threads per inch. Multiplying as above I obtained:

Diametral pitch $5 \times 7 = 35$ for the driven gear.

Lead screw pitch $2 \times 22 = 44$ for the driving gear.

As the spirals were required to have 20 teeth, the driving gear must be multiplied by 20. Had there been 30 teeth I would have multiplied by 30, and so for any number. Multiplying thus by 20 gives:

$44 \times 20 = 880$ for the driver.

Compounding these gears gives:

$$\frac{880}{35} = \frac{120}{15} \times \frac{110}{30} = \frac{\text{driving gears}}{\text{driven gears}}$$

which were the wheels used.

It will be noticed that these gears cut a pitch almost exactly equal to the circumference of the spirals at the pitch circle, which is 12 4-7 inches, this being, closely, the distance the carriage travels for each turn of the lathe spindle when the above gears are used.

I then procured a tool holder made from 1½-inch square steel about 12 inches long and drilled a ½-inch hole 2 inches up, taking care to have it square with the sides. I filed a tool the correct shape of tooth from ½-inch round steel, fastened the holder in the tool rest, being careful to have the tool or cutter in line with the lathe centers; placed the 120-wheel on the lathe spindle and marked every sixth tooth, thereby using it as an index plate for the 20 teeth.

Thinking everything would now be plain sailing, I started to cut the teeth in the same manner as I would cut any ordinary thread, but soon discovered that the tool was too wide, as I had made it .314 inch in width, which would be about correct for cutting an ordinary gear. It was quite a problem to me at that time to know just what thickness the cutter should be, and I had no time to write to the AMERICAN MACHINIST for information. After a little thought I arrived at a solution, as shown

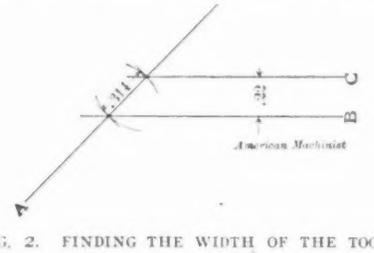


FIG. 2. FINDING THE WIDTH OF THE TOOL.

in Fig. 2. On a piece of sheet iron I drew line *A* at 45 degrees to the bottom of the sheet, because the teeth were to be at that angle, and pricked off on line *A* the distance of half the circular pitch of an ordinary gear of that diameter, which was .314 inch. Lines *B* and *C* were then drawn and the distance between them, .22 inch, was found to be about the width the cutter should be.

I do not know whether this was mathematically correct or not, but I do know that after cutting the teeth and parting the casting, the gears, when in place on the shafts, meshed first rate and were considered by all concerned a good job.

The question most frequently asked while working at them was: how do you know they will be at right angles after you get them cut? I confess I was not dead certain myself, but I did not say so and drew a long breath of relief when I saw them mesh so nicely.

I might add in conclusion the pair which had become worn out after so many years of constant use had been cast. I have since spoken to several molders about them, who have all said they could not see how it was possible to draw them out of the sand.

M. H. WESTBROOK.

Stratford, Ontario.

An Alleged Breach of Confidence.

Editor American Machinist:

I was much interested in the letter by "Perseverance," at page 561, as it brings similar circumstances to my mind.

I was at one time employed by a firm who manufactured locomotives, and in the drawing-room was a young man who thought he knew enough about locomotives to apply for a better position. He accordingly wrote to a prominent railroad, asking them for a position in their drafting-room. It so happened that at that time we were building several locomotives for this same railroad, and it also happened that the chief draftsman of the railroad was a friend of our chief draftsman, and he *considered* it his *duty* to inform our chief draftsman of the fact, and the result was it entirely changed this young man's prospects, and things were made so disagreeable for him that one of the men finally put him in the way of another position.

Since that time I have taken charge of a drafting-room, and it has of course been my duty to hire the men, and I have found that it has been necessary for me to nominally agree not to hire a man so long as he is working for certain firms with whom I am in friendly relations, but I do not consider that I am bound or expected to inform them if one of their men applies to me for a position. I consider that every man has a right to better himself, and if he is worth more to someone else than I can afford to pay him, then I shall be the last one to stand in his way, even though I may not care to lose him.

A man has his labor to sell and he will of course try to sell it to the firm who will pay the highest price and who does not ask for a big discount, and no firm owns a man enough to say that he shall not apply for a better position if he wishes, although I know of several who think they do.

H. DANFORTH.

The Foundry Trade School.

Editor American Machinist:

In answer to Mr. P. McNaughton's letter at page 529, I would say that I do not believe he has studied my article very closely. He says "colleges are all right to refit and finish up a mechanical investigator or student," etc. It seems to me that no one should have drawn the conclusions Mr. McNaughton does. The article is plain in showing that the aim is to insure a practical training in a regularly operating foundry, going into the open market to compete for trade, and not such a foundry as colleges conduct. The technical training is proposed to be given after working hours. Mr. McNaughton suggests that the government enact an indenture law binding the student and proprietor to fulfill their contract. Unless the school was of the character which I propose such a law would be of little benefit, and I believe that private enterprise will best operate such a school to the interest of all concerned. The government has yet to demonstrate its ability to create the master mechanic, one who knows not only how to do, but who can do with the despatch that competition demands, to place our mechanics in the lead of the nations.

JOHN D. WEST.

Editor American Machinist:

I was much interested in reading Mr. West's article, on page 441, about the proposed foundry trade school. It seems to invite, or perhaps more correctly in my case, to provoke discussion. My interest in the article does not imply that I agree with it or that I can see any wisdom in Mr. West's scheme. I have to confess that I was very much surprised to find such a proposition emanating from and earnestly advocated by a successful practical foundryman. The same proposition if advanced by a professional educator would not have surprised me in the least. In the latter case, however, it would not have been the same proposition in one important particular. The modern professor very distinctly would not have proposed a self-sustaining institution. He has no conception of any such thing and in these days never suggests it.

Mr. West, indeed, wants money to start with, but he seems to be confident that after the thing was established and in full working order it would at least pay its way. Never for a day. It would be omniverously eleemosynary from the word go, and its conductors should be more expert in begging than in molding.

Mr. West must know as well as anyone can know how insistent are the conditions under which alone any foundry can be profitably conducted. All of the most essential of these conditions he proposes to throw away, and yet he does not seem to expect that the accompanying results will be thrown away with them.

The idea of doing actual work as the only way to learn how to do it or to acquire the practical skill to do it is all right, and it is, I think, more emphatically true of molding and casting iron, in the volume and variety demanded, than of any other of the trades. I have at one time or another visited the play-shops, as I have to call them, for I always think of them in that way, which are connected with some of the big technical educational institutions, and I have seen the collections of specimens of the work that has been done in the various shops—carpentering, wood turning, pattern making, blacksmithing, machine work, molding, and I have noticed everywhere that the molding department has always made the least satisfactory display, and that the specimens in that line, if shown at all, have been exhibited with the least ostentation. In connection with the graduating exercises of one of the trade schools in New York city one of the graduates molded and cast in the presence of the audience assembled a small flywheel of lead. That was an absurd exhibition from either Mr. West's view point or mine, but it suggests the grade of skill a foundry trade school may be expected to develop.

Mr. West certainly would not be satisfied, and does not propose to be satisfied, with such an exhibition. He would want to produce *bona-fide* castings and castings which require high skill to produce; and no doubt with a foreman who was an experienced molder, and with unlimited time, he and the young men might once in a while worry out an isolated casting that would pass inspection, but there would necessarily be more total failures than anything else, and many scabby and imperfect castings that might be doctored up so that they would go; but that is not business, you know. That kind of work could not hold customers anywhere at any price, so that the scheme of living by the profits of the work done would not be possible even if the young men could work without any compensation. The most profitable, or the least unprofitable, times would be the vacations. It would of course be possible to get into a line of repetition work where the same thing, if very simple, could be numerously reproduced, and in this each young man, after running his gamut of blunders and learning in detail the manipulation and treatment required for that particular piece, might be able to go on making it without loss, but that is done in the regular shops, and that is the thing which Mr. West proposes to get away from, as it cannot possibly develop the all-around molder.

The "hatful of eyes" which the oculist must spoil before he becomes an expert has its counterpart in the foundry, and no reconstruction or special arrangement of a foundry can evade the price at which skill is acquired. The elementary operations of any of the trades are easy enough to learn, and various trade schools give opportunities for this and are satisfied, and, what is as important, their patrons are satisfied, with exhibitions of cheaply acquired facility, but the trade is not advanced. The lower grades of skill are cheap enough to develop, but the *top* skill, which Mr. West is after, the schools are powerless to produce. They cannot command in any case, and even Mr. West's scheme cannot secure, the variety of work and of conditions, and the continuous doing of work under the imperative conditions which would alone constitute the needed opportunity. Above all, no school can supply the incentive by which the actual worker is driven and to which his skill and excellence are ultimately owing. It makes no particular difference to a student worker whether a casting is all right or not, and all right every time, but to the fellow in the shop it means his job, his living and the comfort of those he loves and works for. It would be a marvel of marvels for a worker in any possible school, even Mr. West's, to go on finding out and perfecting new and improved ways of doing things, for there would be no money in it for him, but in the actual everyday foundry, with the incentive of a prospect of better pay or better position, that thing goes on all the time, and to it the progress of the trade is due. Schools can teach many things, many necessary things, and I would be the last to say a word other than in their favor, but no school can be made to produce skilled molders except the life school of daily, actual, *bona-fide* work.

TECUMSEH SWIFT.

The Foundry Trade School—A Voice from the Foundry Floor.

Editor American Machinist:

At page 441 you have an article by Mr. Thos. West, relating to a foundry school. All very nice. He is going to get a class of men in there that don't want to get their hands soiled; he is going to put in the men who would otherwise be clerks or office men. Now please tell me how he is going to teach them the trade in a school without their soiling their hands. Oh, yes! I forgot he is going to put in a bath-house and have all the conveniences there that he would have in an office. Won't that be nice? But what are these men going to do when they get out of school? Are they all going to be bosses? Oh, no; they will be practical foundrymen and will go into other shops and work as molders.

If the National Foundrymen's Association wants to keep the better class of workmen in its employ and get good results, it can do it in a less expensive way than by starting a school. Let the foundrymen put in a toilet-room in their foundry, where a man can clean himself up a little before he leaves the shop, and in less than six months you will see a difference in the molder, and the man that is careless

and neglects himself will soon get ashamed and get out of the shop or take a little more pride in his person and also in his work. I am an iron molder myself, and I voice the sentiments of a good many of the molders of this country.

D. C. GILLILAND.

The Scrapping of the Bethlehem Steam Hammer—The Midvale Hammer.

Editor American Machinist:

During my employment of nearly two years at the Midvale works, I saw many heavy forgings made under the 40-ton steam hammer, and after the completion of the hydraulic forging plant, in November, 1900, I saw similar forgings made by that. Undoubtedly the hydraulic forgings are of a better grade. They are much closer to size. Where the lathes had to take off 2 inches or over from the hammer forgings they have now only ¼ to ½ inch of roughing cuts from the hydraulic forgings, and the latter have fewer imperfections to be chipped out. The main point, though, is that the steam hammer in forging heavy masses does not act uniformly through the body of the metal. The effect is mostly on the outside alone and the interior parts are not properly compressed. In forging a shaft 20 inches diameter and 30 feet long a solid steel ingot of about 25 tons is required. Such an ingot opposes its inertia to the momentum of the falling hammer and before the force of the blow reaches the central parts sufficiently to compress and elongate it is mostly absorbed by the outer portion, causing either a tearing asunder of the interior or the sliding of the outer portion over it, the hammering often shutting in the scoriæ, scale and gases instead of expelling them. The hammer forging shows deep cups in the ends, while the hydraulic forging will show a rounded end. The effect of the press therefore is toward homogeneousness, from even a porous ingot. Such uniformity of consolidation is simply not attainable under a steam hammer. The press being noiseless and without concussion, it is easier to manage than the hammer.

Mr. Wertheim, page 530, tells of the risk he ran of being "fired" for finding out things about the Midvale hammer. There are no big secrets about it to make it worth while to "fire" anybody. On one secret, how to stop the roaring noise of the exhaust, the Sellers firm have experimented, but without much success. The Midvale company has not yet decided to scrap the hammer, as it would involve other costly tools and three heating furnaces. It is contemplating the extension of its new forging plant by the addition of a new press of double capacity with two 150-ton cranes, and so very likely the hammer will yet be first thrown out of work and then out of the way. U. PETERS.

Glenville, Ohio.

Faulty Application of the Metric System.

Editor American Machinist:

Just now the technical journals are much concerned about the metric system and its introduction, there being much said against it and a little in its favor; and since I have at various times used the system I naturally have some definite conclusions about it.

As to the basic unit length, whether it be the length of some king's arm, the length of a pendulum vibrating seconds, or some portion of the earth's questionably determined quadrant length, makes very little difference according to my notion.

We are taught the world over to use a decimal arithmetic, and this will likely continue a long time, notwithstanding there would be considerable advantage in a duodecimal arithmetic. After all, we must use the decimal arithmetic for all our calculations; then why not gracefully acknowledge that the measuring scales should be decimally divided to match? We then could compute any scheme of sizes, whether decimal, duodecimal or binary, so long as each size is some convenient multiple of the lesser unit. In the industrial arts we find it convenient to adopt magnitudes that we can subdivide into halves and quarters, likewise to thirds and sixths, but rarely is there occasion to divide to fifths. The decimal notation, other than being divisible into halves, affords us a division that we have little use for, though it denies us a simpler division that we have great use for.

For quite a while during my earlier experience with the metric system I made free use of the centimeter and its half as conspicuous magnitudes; that is, I conformed to a decimal scheme of sizes, and certainly I was not in love with the system, but was disgusted with how the thing worked; therefore, I abandoned the metric system. In my present use of said system I do everything I can to avoid using the centimeter and its half as a simple component of larger magnitudes than one centimeter. Twelve millimeters, the half of such and multiples thereof are my favorite magnitudes, aside from which I use millimeters in two's for all sizes above one centimeter. From this you see I have a duodecimal system that is readable decimally direct from the measuring scale. Since using the metric system, as stated, I like it very much, and while it entails some expense in new tools, it also affords an escape from the many barbarous monstrosities connected with the use of the inch measure, not the least among these being the practice of screw-thread pitches as constituting various awkward divisional parts of the entire inch, rather than each thread-pitch being a simple multiple of some convenient smaller unit. As regards thread pitches being divisional parts of a larger unit, I am intensely sorry that the English have adopted for their standard this same unfortunate idea for their threads in metric measure, for they have divided the centimeter into fractional parts instead of making each thread pitch a complete number of lesser simple units. Much can be said concerning a better system for screw threads, but it should constitute a chapter by itself. H. C. HECKENDORN.

Philadelphia, Pa.

Remarkable Case of Wear in a Ball Bearing.

Editor American Machinist:

I think that Mr. Stanton's experience with the ball thrust bearing, as given at page 531, stands unparalleled in the history of the ball-bearing business. It is certainly a very remarkable case of wear, with emphasis on the remarkable.

Having had considerable experience in the last four years with ball bearings of all kinds, a case of so rare occurrence as this has naturally led to some speculation as to the probable cause of the phenomenon. It is difficult to understand how there can be much wear without considerable friction of some kind; the bearing in this case was protected against the entrance of grit or other foreign substance. A properly constructed ball bearing is practically frictionless; when not loaded beyond the elastic limit of the balls, and kept free from rust and foreign particles of all kinds, it may run for years with apparently no signs of wear either of balls or races.

Other things being equal, rust and overload are the chief factors tending to the deterioration of the ball, and consequently the races. After a ball has been running overloaded for a considerable length of time, it becomes checked and pitted where the surface has scaled off. This sometimes commences at one spot and increases in an ever-widening circle; in other cases it is unevenly distributed over the surface of the ball. The particles of hardened steel thus removed are ground into the race by the moving balls, and so hasten the destruction of both.

In the instance above referred to, this action evidently did not occur, the balls having been gradually reduced in size, as in a ball-grinding machine. It takes, say, 20 minutes to grind a 1-inch ball from the rough to the finish. Let the diameter of the ball in the rough be 1.008 inches; this makes about 0.013 cubic inch to be removed in 20 minutes, or 0.039 cubic inch per hour.

One-inch ball = 0.524 cubic inch. A ball 0.564 inch diameter = 0.094 cubic inch. 0.524 — 0.094 = 0.43 cubic inch per ball removed by the water-wheel in 9 months, or 2,340 working hours, making 0.0002 cubic inch removed from a ball per hour without emery and oil, as against 0.039 cubic inch removed by the grinding machine.

During the nine months, 0.430 cubic inch × 18 = 7.74 cubic inches of hardened steel were removed—the 75 horsepower water-wheel having evidently been engaged in performing a class and quan-

tity of work that it certainly never was designed to do.

In conclusion, with all due respect to Mr. Stanton, had such a phenomenon as this taken place in a bearing of my design, I would have been unable to believe my own eyes, and the impulse would have been to go "gunning" for the person who assembled the bearing with 9-16 inch balls, 0.0015 over size, instead of the 1-inch ball for which it was designed. S. B.

The Gathmann Gun Test.

Editor American Machinist:

The interesting account of the "Gathmann Gun Tests" at page 81 ends up (rather unsatisfactorily to me) on the supposition that your readers know all about the results of the tests from the daily press.

I think I happened to see one reference in a daily paper, and that said the test was a total failure—a statement that, in the light of the article referred to above, seems questionable. Therefore will you kindly publish what are the true conclusions drawn from the tests?

NATHAN RICE.

Editor American Machinist:

It is not surprising that your correspondent has reached the conclusion, from an examination of the photographs of the Gathmann target, that the recent tests were not an entire failure. In fact, this conclusion was reached by many of those who witnessed the firing, and there are many who believe that the official board in whose hands was left the conduct of the tests made a mistake in so completely condemning the results obtained by the Gathmann system of projecting high explosives. Without in any way advocating the adoption of this method of offensive warfare, it is believed that the official report could well have given credit to the Gathmanns for what they undoubtedly did accomplish. That the superiority of the service 12-inch rifle, firing an armor-piercing shot containing high explosives, was unquestionably demonstrated is certain, but to say that a blow great enough to move a mass weighing upwards of 100 tons something like 8 feet in the fraction of a second would not have structurally damaged, or even destroyed, any battleship afloat, is, to my mind, to belittle the strength of one's adversary—a dangerous practice under any conditions. Another result of this feature of the official report is to give the Gathmann adherents—and they are many and influential—an opportunity to criticise the accuracy of the remainder of the report and the spirit of absolute conservatism which rejects any innovation in the system of defense devised by those in the employ of the government.

The issue of the *Scientific American* for November 30, 1901, contains an excellent account of the Gathmann tests, while the *Army and Navy Journal* for December 7, 1901, contains the report of the board conducting the tests, and to anyone interested in the subject, I would suggest reading these articles.

A WITNESS OF THE TESTS.

Business Courtesy—Breaches of Confidence—A Man's Right to His Market.

Editor American Machinist:

Your correspondent, "Perseverance," at page 561, asks the opinion of readers of the AMERICAN MACHINIST concerning a matter which has recently come to his knowledge. It seems that a certain man in the employ of a certain company and dissatisfied with either his work, his pay or his prospects, or possibly dissatisfied in all those particulars, wrote to another company asking if that company had any vacant position which he could fill. "Perseverance" puts it in entirely different words, but I think I accurately state every fact of the case, as far as I have here gone with it. It might be stated still differently and more simply: A seller of work writes to a possible customer asking him if he wants to buy work.

I can't very well help having an opinion about this kind of thing, and I don't need much urging to tell it. If there is anything that the business world believes in more implicitly than in anything else it is in the necessity of soliciting. The business which in these days could get along without it would be a very peculiar business indeed. To talk of the right of a manufacturer or of a merchant to inform anybody or everybody in the world that he has goods to sell would be an absurdity. There are those, however, who have different views and different practices when it comes to the buying and selling of labor. See what happened in this particular case. The company which was simply asked by letter whether it wanted to buy such labor as the writer wanted to sell did not even reply to him, but sent his letter to the company which was then buying his labor, and the latter company thanked the former company for this act of "business courtesy." Business courtesy is thus, it seems, something quite different from what I have always understood it to be. I have always thought it to be a most admirable thing, but I don't admire this trick, and I don't see how anybody else can.

But this is not the end of the story. The head draftsman, also presumably a salaried man, and in this case apparently obeying the behest of one higher in authority, brings the letter around to the writer of it and charges him with having committed a heinous offence! It seems that while in employment he had no right to address a letter to another company about employment. I should have thought, as I have always thought, that I had a perfect right to do that thing, and I should have thought that it was no one's business but my own and that of the party addressed. When a fellow finds in practice such a different way of regarding and handling the matter it "breaks him all up," and it is hard for him to tell "where he is at."

I can't help thinking how different it would have been if the thing offered for sale had been, for instance, leather belting instead of the services of a draftsman. Suppose some machine works to be regularly buying belting from a certain manufacturer, and suppose that the belt man sends a formal letter or a printed circular to another machine works saying that he has belting to sell and asking if any belting is wanted. Would it be possible for any sane man to imagine this second machine works sending the letter or circular to the first concern, or the latter receiving it with thanks for the "business courtesy"? Instead of business courtesy it would be business idiocy.

The writer of the letter was perfectly right in charging the company to whom it was addressed with a breach of confidence. He could have charged them also with malice in the act, for they deliberately did what they certainly knew would make more or less trouble for him. It is things like this which help to break up all friendly relations and all reciprocal obligations between employer and employee. It may be "business," but it is most short-sighted business, and the disgusting thing about it is that nothing is gained by it. The employer, as a class or as an individual, cannot afford in the long run to lose the good will of the employee either individually or collectively.

There is quite a lot of this sort of thing done, only a little of it ever coming to light. This letter that we are talking about might have been sent to the man's employer without his ever hearing of it, and that is probably the most frequent occurrence. There can't be two opinions about it. The writer who asks for the opinions of the readers of the AMERICAN MACHINIST about this sort of thing will probably discover practical unanimity as to the contemptibleness of it, but there are still many, both employers and employees, who recognize a certain policy in it and who assume that a certain advantage must accrue to the crafty and unscrupulous employer, and herein lies the mischief of it. It is this idea which encourages and maintains the nefarious practice.

It is assumed, of course, that if the employee had an absolutely free market for his labor, and if the employers all held themselves free to bid against each other, and to hire anybody they wanted and to pay whatever would be necessary under such conditions, that wages or salaries would go sky high and that business profits would disappear. Don't you believe it. Labor, like everything else in a free market, would soon have its price automatically and accurately adjusted to its value, and the price could not be maintained higher. If wages should go slightly higher than under the traditional arrangement, this would entail

no disadvantage to one employer as compared with another, all being then exposed to the same conditions. The absolute discarding of the kind of "business courtesy" herein discussed would place all competitors on the same level, instead of giving or promising to give temporary advantage to the sharper. The great gain would be that the good will of the employee would be secured and retained and that he would be subject to higher incentives to faithfulness and excellence. He would need no longer to feel that there was an organized conspiracy against him or that he was being defrauded of his right to his natural market. So long, however, as he is treated with systematic dishonesty the human nature in him will have to be reckoned with.

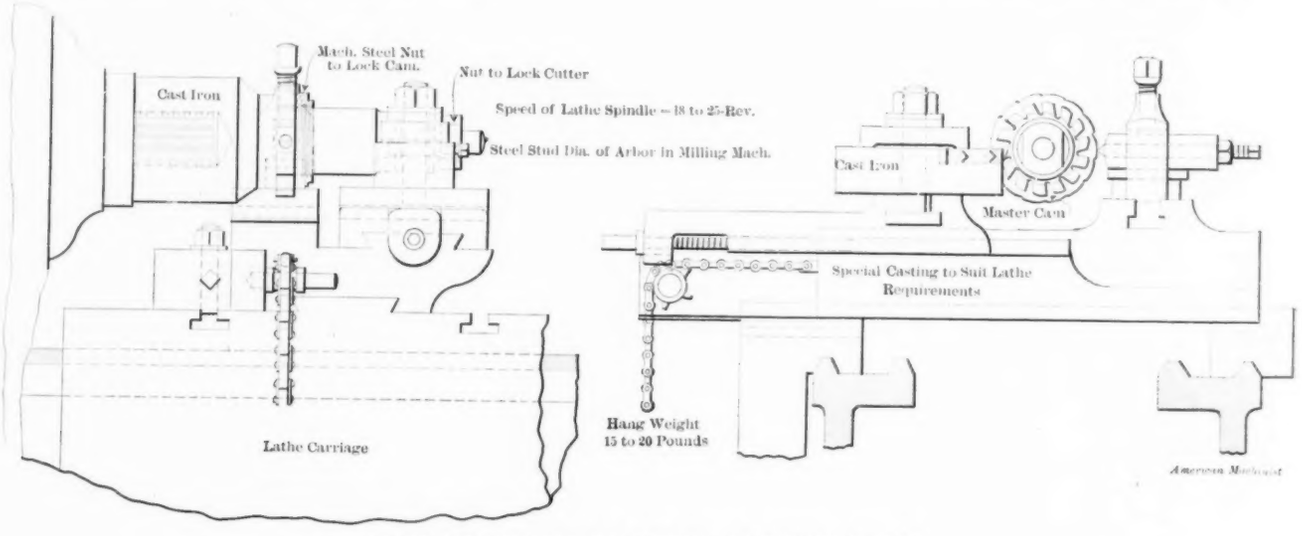
TECUMSEH SWIFT.

Lathe Arrangement for Backing Off Milling Cutters

Editor American Machinist:

I send you a drawing of a lathe attachment in actual use for backing off milling cutters. In the shop where this is working, the proprietor was unable to buy milling cutters as required to keep his shop going, and after a short talk with the superintendent they concluded to make up "something cheap" to back off the cutters, and this is what they arrived at. Now they make all the cutters they use. The master cam with the adjustable feeler at the back moves the lower sliding block, while the upper slide is still adjustable by the screw to feed the cutter in or out.

BILLY MURPHY.

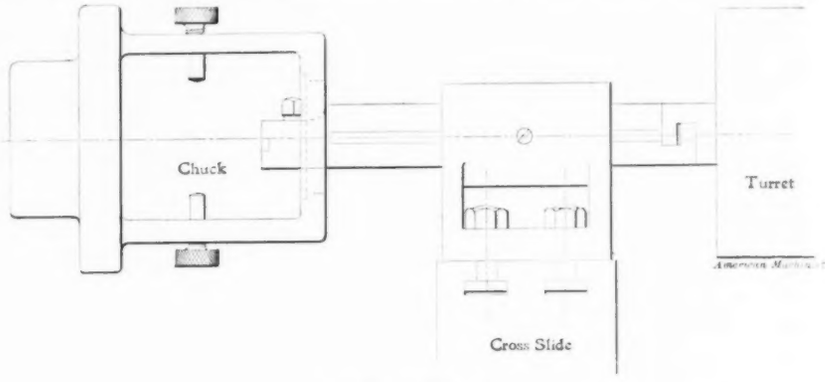

Mach. Steel Nut to Lock Cam.
Nut to Lock Cutter
Cast Iron
Speed of Lathe Spindle = 18 to 25 Rev.
Steel Stud Dia. of Arbor in Milling Mach.
Cast Iron
Master Cam
Special Casting to Suit Lathe Requirements
Hang Weight 15 to 20 Pounds
Lathe Carriage
American Machinist

LATHE ARRANGEMENT FOR BACKING-OFF MILLING CUTTERS.

A Novel Boring Rig for the Turret Machine.

Editor American Machinist:

The outfit shown in the engraving was designed to replace a reamer, and it bores a 2-inch cylinder as nearly true in every way as anyone could wish. The rig consists of a boring bar containing a piece of air-hardening steel held by a set-screw; a cast-iron bracket for the cross slide with a brass bushing for the bar to slide through, and a piece held in the turret which engages the back end of the bar and feeds it in and withdraws it. The equipment is used on a screw machine which has a power feed for the turret, and the casting to be bored is held in a special chuck on the spindle. The job is a particular one, the limit of error in diameter is very small, and the axis of the bore must be exactly at a right angle with the face of the cylinder.



A NOVEL BORING RIG.

The bracket has a rib on the bottom to engage the slots in the cross-slide, making it possible to set the bracket and bar in exact alinement with the axis of the lathe spindle. The front stop on the cross slide gives the size of bore and can be adjusted minutely. When the cut has progressed to the bottom of the cylinder the cross-slide is moved toward the center of the machine a little to enable the operator to withdraw the tool without leaving a helical groove in the cylinder. It is saving money in three different ways over the old reamer previously used. It saves the cost of expensive reamers; it saves the time of a machinist, who was almost constantly on hand with an oil-stone, and it saves two-thirds of the time formerly used in the next operation—that of grinding in the piston.

ROGER HAINES.

Neglect of the Oil Can.

Editor American Machinist:

How insignificant a looking thing an oil can is, but what serious consequences follow the abuse or the ignoring of its contents. I have in mind just one little instance of its value. In our drawing room we have a blueprint frame of a special design. The frame proper is supported by a yoke, and this yoke is in turn supported by a triangular frame on the outer ends of which two rollers are pinned. These rollers roll upon a track which is supported by brackets from the ceiling. The frame refused to move the other day without great exertion on the part of the operator. We all as usual furrowed our brows and looked for trouble. One suggested that the wheels or rollers were getting flat faced and gripping on the track, another suggested taking it down and dismantling it to see what really was the trouble, while another genius dashed out and returned in high glee with an oil can. We all felt like a pack of dummies. When we put a few drops of oil on the axles, the oil-can genius gave it a push and away she spun. This little incident happened where the engineering talent and the brains of the establishment were supposed to be concentrated.

The other day one of our best customers called on us and said: "Look here, Mr. Blank, if you people do not use better material in your work I will have to look elsewhere for my machinery; I want one of your men to come up to my place and see those sleeves you furnished two years ago. Those clutch-pulley sleeves, I mean; they wabble as though Old Nick was in them, and then there's those 48-inch sheave wheels you furnished; it makes me giddy to look at them."

He left with the gentle reminder that we must improve in our work or lose his business. The oil-can genius looked over at me and said, "Another case of the lack of a few drops of oil," and he was correct in his supposition.

Those sleeves were 18 inches long and 3 7-16 inches bore. The ends were bushed for 7 inches, leaving an oil chamber in the center 5 inches in diameter and 4 inches long, which chamber was easily accessible to fill with oil. From the time those sleeves were put up until the time of the complaint, which was two years after, the sleeves were not oiled. What our man put in should have lasted from two to three weeks.

Upon taking down the sleeves we found that the bushes were entirely cut out. All we did was to lay them in a pile and proceed to inspect the 48-inch sheave wheels. I might say that the shafts on which the sleeves were working were cut about one quarter through. In the case of the sheaves we found the same conditions, except that the oil chamber was considerably larger. This was of no account unless it had been refilled occasionally. We put all the sleeves and sheaves in a pile and sent for the "boss," and prepared ourselves to talk and take our turn and kick. And kick we did. I have had the pleasure of seeing several men do what is commonly called "taking water," but he beat all. His apologies were profuse, and before we left he gave us the order to duplicate the parts that were worn beyond repair. We in turn advised him to put the responsibility of oiling his machinery on some reliable person, and a person with some brains at that, and to see that an inspection of all bearings, sleeves, oil chambers, be made at some convenient time when the machinery was not in operation.

We have heard since from our customer, and he states in glowing words that he has appointed a man as we suggested and finds that there is quite a saving in coal and in repairs. These instances are only a few of a large number which are coming to our daily notice. Time and time again we have had people come to us and state that the machine we furnished them was not working properly, and when we have sifted matters have found that they had forgotten the use of the "oil can."

S. P. Y.

The Committee's Report to Congress on the Metric System.

The House Committee on Coinage, Weights and Measures has recommended for passage the bill making the metric system of weights and measures the standard system in the United States, though it by no means follows that it will even pass the House, much less become a law. If it does not, it will be because it has aroused a great deal of opposition which we are convinced is based upon an entire misunderstanding of the intent and import of the law.

Some of the statements made in the committee's report are as follows:

"The advantages to be gained by the adoption of the metric system as compared with the one in present use are far greater than the benefits derived from the adoption of a decimal system of coinage in place of the English monetary system."

. . . . . .

"An examination of the tables of our weights and measures discloses the fact that there are 64 different ratios used, of which 19 are not divisible by 2, and that there are 18 terms used which have two or more meanings. Certainly any effort to replace this conglomerate system with a simple, logical one, similar to our monetary system, is worthy of the consideration of Congress."

"The metric system of weights and measures was devised as an international system. The fact that it was first adopted by France has given rise to the custom of referring to it as the French system. It is interesting to note, however, that one of the first to propose a decimal system of weights and measures was James Watt, the inventor of the steam engine. The adoption of a decimal system of coinage by the United States was one of the strongest influences leading to the adoption of the metric system by France.

. . . . . .

"The advantages of the metric system may be briefly stated as its decimal character throughout, the simple relations between the units making it possible to derive all others directly from the unit of length, its elasticity (being equally convenient for the measurement of the smallest or largest objects), the ease with which it is learned and remembered, the saving of time, and the increased accuracy with which computations may be made. These advantages have been proven by a century of use, but that which especially commends it to us at the present time is its international character, since it is the opinion of all who are in a position to know that the world must soon come to an international system of weights and measures, and that there is not the slightest possibility of our own system or any modification of it becoming universal.

. . . . . .

"The benefits to be derived from the adoption of the metric system by the educational interests of the country are perhaps the most important that have been brought to the attention of this committee. Estimates made by the Department of Education and others show that the work of at least two-thirds of a year in the life of every child would be saved by the adoption of the metric arithmetic. The British Parliamentary committee having in charge a similar investigation estimated the saving of time at one year. This is a matter the importance of which can hardly be overestimated, taking into consideration the large amount of work to be covered in the curriculum of the schools and the enormous sums annually devoted to educational work. The metric system is taught in nearly every school in the country. Teachers and pupils alike unanimously testify as to the ease with which the system is taught and learned and the facility with which it is applied to the problems which in ordinary arithmetic are complex and difficult to solve. When we consider that there are over 15,000,000 school children in the United States being educated at a public cost of not less than $200,000,000 per year, the enormity of the waste will be appreciated. In the lifetime of a single generation nearly $1,000,000,000 and 80,000,000 school years are consumed in teaching a system which is in harmony with that of no other nation of the world.

"It is a matter of evidence on the part of educators in the United States, Great Britain and Continental Europe that the metric system and its application to the solution of problems may be learned in one-tenth the time required for gaining an equal facility in the use of the English system of weights and measures. It is doubtful whether any measure of more vital importance and benefit to the educational interests of the country has ever come before Congress.

RELATIONS TO MANUFACTURING INTERESTS.

"It should be emphasized that this measure in no way contemplates any change in existing technical standards, such as screw threads, wire gages, lumber measures, and numerous others, except as manufacturers and other interests involved find it to their interest to make the change. Doubtless a change in the fundamental standards of length and mass would facilitate the simplification of such standards; but the changes would still be brought about as heretofore by the special interests involved.

"Any change in the standards employed in manufacturing, no matter how perfect the system proposed or how beneficial the change may be, must be very carefully and judiciously made. In the case of textile fabrics, materials of construction, package goods, and almost all kinds of manufactured products, a change would no doubt involve some inconvenience, but the expense of modifying existing plants or machinery would be very slight. In many cases no change or expense would

be necessary, and the benefits to be derived from a convenient and universal standard would far more than compensate for the expense and confusion temporarily involved during the transition stage.

"In no other country has the construction of machinery reached a degree of perfection superior to that of our own, a result principally due to the system of interchangeable parts. The latter may be said to be a product of American ingenuity and to be the greatest single advance in modern machinery. It has for its essential features a uniform standard of length and accurate length-measuring instruments. This work has been done upon the basis of the inch, which in many cases has been decimalized.

"There are a few who claim that the inch is better suited for this purpose than the units of the metric system. However, it should be kept in mind that the interchangeable system does not depend upon the unit used, but upon uniform, reliable standards and accurate measurements, and it is difficult to see why the inch and fractions of an inch should be superior to the centimeter and decimals of a centimeter. German, French, English and American manufacturers are successfully manufacturing upon a metric basis and have shown no desire to return to the old system, notwithstanding the fact that the change has been made in the latter cases under very adverse circumstances.

"It is admitted that the temporary inconvenience caused in the shop and drafting room by the proposed change would be very serious if suddenly brought about, but any measure which contemplates only the gradual introduction of the one system for the other, or even the continuation of the old in case it is desired, cannot be said to be compulsory or capable of producing more than a minimum of inconvenience or expense, and certainly an interchangeable system upon an international basis will be superior to one based on the standard of a single country."

The report quotes the words of Theodore C. Search, president of the National Manufacturers' Association, as follows:

"Wherever manufacturers undertake to extend their trade in foreign countries, they encounter the metric system, and it is the only system of absolute uniformity which prevails throughout the world. The pound, the quart, the gallon, the ton have varying values, wherever encountered in foreign countries, and to insure accuracy the use of these units requires further explanation and some qualifying description in order to indicate just what quantity is meant. The enormous growth of our export trade during the past four years has brought our manufacturers in touch with the outer world as never before, and has given very practical illustration of the cumbersome character of our methods of measurement, and the advantages to be derived from the adoption of a system which is absolute and uniform throughout the world.

. . . . . .

And as we have only just entered upon a commercial conquest of the world, the utility of the metric system will become more and more apparent and the necessity for its adoption more urgent with each year of our growing export trade. The extension of our governmental functions to the Philippines, Cuba and Porto Rico brings into the circle of our commercial operations millions of people to whom the metric system is the recognized standard and to whom our own cumbersome system of weights and measures are a strange and unknown language of trade.

"We recognize that any effort to supplant our present system of weights and measures with the metric system will be attended with more or less difficulty, and will involve some trouble for many of our manufacturers, because of the necessity of changing drawings, patterns, and standards, but we believe it entirely possible to accomplish such a change by gradual steps, and there should be no necessity for causing loss or injury to any of our industrial interests.

"It seems to me that every argument is in favor of the unification of standards of weights and measurements throughout the world, and for us to insist upon an adherence to our antiquated standards is not in accord with the progressive nature of our people and the progressive tendency of this age."

Concluding, the report says:

"The countless transactions involving the use of weights and measures make any proposition involving a change a most important one. The decimalization of our own system of weights and measures has been proposed by a few who have failed to consider the importance of an international system and the utter impossibility of the rest of the world adopting such a system as our own, however it may be improved in form. A change of this sort would be incomparably more radical than the adoption of the metric system. It has also been proposed to modify the existing system to one having a base of eight or twelve on account of the possibility of continued binary subdivision, but here again not only is the importance of an international system overlooked, but the impracticable idea is proposed of combining such a system with a decimal system of numbers. When the base of our system of numbers is changed to some other than ten it will be sufficient time to talk about a system of weights and measures having the same base.

"It should also be kept in mind that the metric system is just as capable of a binary subdivision as any other, although the advantages of such a division are only apparent in the most ordinary business transactions and for the first few subdivisions. After the adoption of the metric system, the use of the half and quarter meter and half and quarter kilogram would be as common as our half and quarter dollar—smaller quantities would be expressed in decimals precisely the same as in the case of our money.

"In 1866 Congress legalized the metric system. From that time on it has been growing in favor and in practical use. It is here to stay, not only in scientific work, but in commerce and manufacturing. It is now used by about two-thirds of the people of the world. Russia, Great Britain and the United States are the only non-metric countries. Russia has gone so far in the direction of its adoption that it may well be excluded from the list, leaving Great Britain and the United States. In both of these it has been legal for some time. Indications are that Great Britain will soon join the list of metric countries. Over 300 members of Parliament have already signified their willingness to vote to make the use of the metric system compulsory.

"Your committee believe the time has come for the gradual retirement of our confusing, illogical, irrational system and the substitution of something better. The first step in this direction should be the introduction of the metric weights and measures into the departments of the government. The use of these weights and measures will simplify their work. It will familiarize the people with them and encourage their application to the common affairs of life. Your committee have no doubt that the benefits to be derived will far more than compensate for such inconvenience and expense as may be involved in the change."

The Nine Hour Day for Machinists.

THE SITUATION IN WORCESTER.

The situation in Worcester is about as follows: The local lodge of the National Association of Machinists has presented to the employers of machinists in that city an agreement for their signatures, dated April 21, to take effect May 20, which provides that nine hours shall constitute a day's work; that time and one-half shall be paid for overtime up to midnight and double time thereafter, and for Sundays and holidays; that night gangs shall receive similar payment for hours worked over fifty-four per week; that one apprentice may be employed for the shop, and not more than one, in addition to every five machinists, it being provided that where the ratio is now more than above no change shall take place until the ratio is reduced by lapse or by expiration of existing contracts; that an increase of 12 per cent. in wages shall be given, and that grievances shall be adjusted through joint committees or through arbitration by a board of five persons, two of whom shall be selected by the company, two by the

local lodge of the I. A. M. and one by these four.

It is stated that no notice is to be taken of this in any manner. Whether noncompliance with the above demands will result in a general strike in Worcester is at this time not definitely known, though there are rumors of such a strike, and if members of the M. T. A. carry out their plan of ignoring the demand of the men, a strike is probably inevitable.

THE SITUATION IN CHICAGO.

There is not much to report that is new in Chicago, but the International Association of Machinists has requested from a number of the outlying machine shops the adoption of the straight nine-hour day on or before May 20. There has been no formal demand as yet for a 30-cent. minimum scale, but it is said by officials of the Association that, owing to the scarcity of machinists and the drift of the men to the shops where the higher scale is being paid the 30-cent scale is becoming more prevalent.

The Eight Hour Bill.

The Committee of the House of Representatives on Labor has made a report on the bill providing for an eight-hour work day for all laborers and mechanics employed upon work done for the United States Government, including that done by contractors, such as those who may build naval vessels or, in fact, do any work whatever for the Government. Regarding the bill, Chairman Gardner of the committee says:

"The single new contention made by the opponents of this bill, and not urged against previous bill of the like purpose, was that the completion of some work, like large casting, particularly by different workmen under an eight-hour plan, would fail to produce the best results. The correctness of this contention was stoutly denied by practical workers. It is believed by your committee that any real difficulty in this particular is met by the amendment proposed in this bill. This bill is in conformity with the settled policy of Congress, as indicated by legislation covering a period of thirty-four years."

On the subject of labor-saving machinery, the report says: "This effect of modern machinery on the powers of the worker has been a question more immediately affecting the American workmen than those of other nations. The foreign workman had very generally held to the surface theory of some older writers that machinery is a competitor of labor, and the one most threatening to his employment. Hence, labor has strenuously and to a considerable extent successfully resisted the introduction of modern machinery. The foreign laborer has sought to maintain the demand for his services by thus limiting production.

"The United States has now entered the foreign market with the products of more modern and rapid-working machinery. It would seem that an early effect of this will be a forced yielding to the adoption of like machinery abroad. If the longer day adds to the advantage of the competitor, as contended by the opponents of the eight-hour day, it would seem that the more rigidly adhered to the long day the sooner foreign hostile legislation against American products will be invoked. Such legislation is much more likely to be effectively inspired by industrial necessity than by theory, alliance or general mercantile demands."

The contention against the bill that seems to have most force is that it will be impossible practically for an industrial establishment building, let us say, cruisers for the government and at the same time merchant ships for private owners to have the men who may be doing the government work, work only eight hours per day, while all the others work nine or ten. But of course this argument has no force with those who favor the bill, except in the opposite direction from that intended. They know as well as anybody that the effect will be to hasten or force the general adoption of the eight-hour day in establishments doing government work, and probably that is their chief reason for advocating it.

The Anti-Conspiracy Bill.

The House of Representatives on the 2d inst. passed without debate the bill known as the "Anti-Conspiracy Bill," which was discussed and so strongly opposed in a resolution passed by the Manufacturers' Association at Indianapolis. The bill as passed is as follows:

"That no agreement, combination or contract by or between two or more persons to do or procure to be done, or not to do or procure not to be done, any act in contemplation of furtherance of any trade dispute between employers and employees in the District of Columbia or in any Territory of the United States, or between employers and employees who may be engaged in trade or commerce between the several States, or between any Territory and another, or between any Territory or Territories and any State or States or the District of Columbia, or with foreign nations, shall be deemed criminal; nor shall those engaged therein be indictable or otherwise punishable for the crime of conspiracy, if such act committed by one person would not be punishable as a crime; nor shall such agreement, combination or contract be considered as in restraint of trade or commerce, nor shall any restraining order or injunction be issued with relation thereto.

"Nothing in this act shall exempt from punishment, otherwise than as herein excepted, any persons guilty of conspiracy for which punishment is now provided by any act of Congress, but such act of Congress shall, as to the agreements, combinations, and contracts hereinbefore referred to be construed as if this act were therein contained."

The opposition to the bill will now center its efforts upon the Senate. It is believed that President Roosevelt will approve it if it reaches him.

Examination for Mechanical Draftsman.

The United States Civil Service Commission, Washington, D. C., announces that on June 3, 4, 5, 1902, an examination will be held at various places throughout the country for the position of mechanical draftsman in the Ordnance Department at Large, at the Frankford Arsenal, Philadelphia, Pa., at $1,200 per annum. Forms 304 and 375 should be sent for immediately by intended applicants.

A friend of ours in the West sends us an English paper in which is a letter signed "Anglo-American." "Anglo-American" seems to be very much down on everything American and among other indictments he brings against Americans is the very old and threadbare one to the effect that they are not able to manage their own industrial or mining enterprises, but that all good and successful ones are managed by Englishmen or Scotchmen and there are practically no good foremen of machine shops or other industrial establishments in America except those that have come from England. We suppose that those who make this assertion are amused by it or that it serves some useful purpose to them in some way, though of course anyone who has been to America and has had his eyes open knows that it is very wide of the truth.

An incident that has some interest in connection with the discussion in our columns of the subject of home owning by mechanics is found in "Uncle" Russell Sage's recent experience. It seems he has lived for forty-two years in a house on Fifth avenue, New York, which stands on ground belonging to the Gerry estate. During the first period of twenty-one years the ground rent was $700 a year, for the second twenty-one-year period it was $3,300 a year, and now at the beginning of the third twenty-one-year period the price is raised to $12,500 a year. Uncle Russell did some "kicking" about this, but concluded to pay it rather than give up his house. The incident is only one of many going to show that the man who owns his own home is not sure to lose on it. He may win.

The last report of the General Electric Company to its stockholders states in effect that the company has developed methods by which it is expected that electric locomotives will in certain circumstances and for certain classes of service take the place of steam locomotives as now used for surface railways, the report indicating that a considerable advance has been made in this respect within the past few years.

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Compensation of Skilled Labor.

The problem of apportioning equitable and adequate compensation to the worker for what he actually does is not yet completely solved even in theory, and certainly not in practice. The many schemes now in use, and the more of them still on paper, for adjusting the wages to the work cannot all be right or even best, and the best of all is still undoubtedly not the ideal. A valuable contribution to the discussion of this important topic, without here expressing any opinion or approval of all the points advanced, is the paper by John Richards, of which in this issue we print a rather long abstract. Mr. Richards' views upon this general topic have heretofore been fully presented in our columns. The present article may serve to enlighten those who have not read his previous ones, and may stir fresh thought and promote investigation and suggestion upon a subject of vital importance.

Mr. Richards' enumeration of the various systems of payment for labor which have been and are still in vogue shows at once how far the working world is from any agreement upon any one system. The different arrangements under which the work of the world is carried on, and by which the worker secures what compensation he may, as enumerated by Mr. Richards, are: Slavery, daily wages, piece work, gift or premium propositions and the contract system, the latter of which he advocates with his usual ability and earnestness. There are those who are still ready to argue for each of these, including even that of slavery; so that the time when all shall agree upon any one system is still far distant. The day of final agreement will no doubt be most hastened by the most open and free expressions of opinions upon all sides of the case and by the most complete information as to experiences and results. The discussion of the premium plan now going on both here and abroad, which has been induced by our journal more than by any other, and the numerous trials or adoptions of the "plan" indicate the interest in the general topic of wage adjustment, and lead us to look for increased interest and additional contributions to our knowledge in the not remote future. All are at least agreed that present arrangements for paying for work done are not altogether just or satisfactory.

The Metric System—Interpretation of Law by the Dictionary.

In certain parts of New York State the prices of things you inquire about will be quoted you in shillings. "Three shillings" there means 75 cents and "five shillings" means a dollar and a quarter. The people there use these terms simply because they want to, and though our system of coinage has been "*the*" legal one for many years no attempt has ever been made to prevent these people from saying shillings, and the courts will and do enforce the collection of otherwise lawful accounts where the price was originally stated in shillings. It seems just a little queer in view of the numerous examples of this character that can be quoted that there should be such a persistent belief in the mandatory character of the bill now pending in Congress relating to the metric system, and notwithstanding the unequivocal statements of those having it in charge that it is not intended to compel its general use and the carefully written opinion of Attorney-General Knox to the effect that it cannot have any such compelling effect.

Our report of the proceedings of the Association of Manufacturers at Indianapolis states that the general opinion there was that the bill was mandatory and would make trouble for all who preferred to continue using the present weights and measures. Not only was that opinion prevalent, but a categorical statement to the effect that the opinion of the Attorney-General had been expressed to the contrary seemed to have no effect.

Of course, the opinion of the Attorney-General in a matter of this kind is not binding upon a court; that is to say, no court called upon to apply or to interpret a law would be in the least bound by a previously rendered opinion of the Attorney-General, and, had that officer simply given the shortest possible affirmative or negative answers to the questions of the committee no one could have been much blamed, perhaps, for holding a different opinion derived from his own reading of the law. But the Attorney-General does much more than that. He goes into the matter at length and not only says what he thinks will be the scope of the proposed law, but tells why he thinks so in language which it seems to us would be very convincing to anyone not determined in any event to hold a different opinion. It will be recalled that the Attorney-General says:

"Indeed, as each bill prohibits to the departments the use of any other system by a familiar rule of construction, this will be taken as the only prohibition intended, and it will end there.

"But a negative answer to your question does not depend upon a mere rule of interpretation, but is based upon much broader grounds. The result referred to—the making contracts illegal for this cause—can be accomplished, if at all, only by clear provision to that effect, and there is nothing of that kind in either of these bills, which, as to this, merely declares that a system different from that now in common use shall be the legal standard. This by no means declares that no other system shall be legal or be used. It is both elementary and fundamental that a thing which is legal and innocent in itself is not made otherwise by making something else, even its opposite, legal, unless

indeed there be such incompatibility that they cannot co-exist."

And further on he says:

"The terms, figures and characters in common and almost universal use in our system of weights and measures are just as much parts of the English language as is any other portion of that language, and to forbid to the people their use would require as clear an expression of the legislative will as it would to forbid the use of that language in other matters, even if that would be effective. It may well be doubted if it would be within the competency of Congress to forbid to the people, for this or for any other legitimate purpose, the use of this or any other portion of the language in which our Constitution, our laws and our literature are written and in which we orally express our thoughts and feelings. But, however this may be, it is certain that nothing of this kind is done by the adoption as the legal standard of a system of weights and measures different from that now in vogue, and which, so far as the people are concerned, merely adopts the metric system as the legal standard and launches it under government auspices and recommendation without any attempt to compel its use by the public at large."

These are the carefully considered words of a lawyer who before he attained his present official position had acquired a wide reputation as an able man and who had been accustomed to receive large fees from the largest industrial interests for opinions on matters of law. What shall be said of laymen making no pretence to a knowledge of law who yet dispute his opinion, because they find in a dictionary a definition of the word "the" which seems to them to be inconsistent with it? If law could be interpreted by any layman with a dictionary at hand we might do away with lawyers and law courts.

No one can read the words of the Attorney-General attentively without seeing that his opinion rests upon a much broader foundation than a dictionary definition, and why such a body of men as composed the recent meeting of the Manufacturers' Association, accustomed to the employment of good lawyers to decide legal questions, should have preferred their own opinion on this point of law to that of so experienced and eminent a lawyer as Attorney-General Knox is to us somewhat mysterious.

In passing we may say that we were prepared and expected to be charged with advocating the forced adoption of the metric system because we could not agree with those who imagine there is danger of everybody being forced to use it. It is not true. We have not advocated the metric system, much less its forced adoption; if that were possible, which it is not. But we believe that the proposed legislation is a perfectly proper step to take in the direction of trying the system and seeing just what the results may be—a trial which, so far as we can see, will cost machinery or other manufacturers nothing whatever except their proportion, as taxpayers, of whatever increased cost of government work may be caused by it. It is claimed by many sincere and thoughtful men, who have no axes to grind and no pecuniary interests to be advanced by it that the adoption of the metric system will be of very great advantage to the people of the United States. We do not profess to know whether this is so or not, but we do believe, after a somewhat careful study of the whole matter, that the proposed legislation will be nothing else than a means of testing the matter at small expense and with that expense, whatever it may be, borne by all the people in proportion as they pay taxes for the support of the general government. This, it seems to us, sufficiently answers the question: "Why should there be further legislation on the matter?"

The American Smelting and Refining Company gave notice to certain of its employees that beginning May 1 a profit sharing plan would be adopted, under which all the leading men of the establishment will participate in the profits of the business.

Word comes from Pittsburgh that the officers of the Amalgamated Association of Iron, Steel and Tin Workers have returned home after a conference with representatives of companies included in the United States Steel Corporation, reporting that an agreement has been made for the coming year regarding a wage scale and that for at least one year from date no labor difficulties are likely to arise in that field.

The first of May was ushered in by numerous strikes in other than the machinery industries, mostly for shorter hours and higher wages. Most of these strikes were of short duration and resulted in victories for the men; showing that in most cases the condition of business is such that employers can ill afford to have the progress of work interfered with, and that prices are such that higher wages and generally better terms of employment can be borne.

We have made some inquiry regarding the chain-driven German planer shown at Glasgow, and referred to by our correspondent who writes under the head of "Notes from a Cosmopolitan's Note-Book," but have not been able to hear of it. There was one shown driven by a wire rope made by Kirchner & Co., of Germany, and which was shown also at Paris, and illustrated and described at page 569, Vol. 24. Possibly this is the planer referred to by "Cosmopolitan."

The firm of Joseph T. Ryerson & Son, Chicago, as a tribute to the memory of the founder of the house, has announced that the company will contribute $1,500 a year toward scholarships or other means of advancing steam engineering and the fabrication and erection of sheet metal in all its forms. Suggestions are invited as to the best way to apply the money.

The New York *Tribune's* art correspondent writes of a picture in the present Salon as follows: "The picture likely to hypnotize the public is 'La Machine,' of which the artist is Jean Veber. It is a large work, superb in color and superbly drawn. A huge dynamo is in rapid motion. On a steel cylinder is perched a nude female figure whose red hair stands on end by the force of electricity, while the ponderous flywheel is crushing to atoms hundreds of human bodies, the victims of industrial trusts and commercial syndicates, while a river of blood flows beneath. This apocalyptic machine picture has an irresistible fascination, in spite of the repulsive subject and the artist's baneful misconception of modern civilization and progress."

I do not think a man should do more than he is paid for, whether he drives an engine or sells corn, but I do know that the man who decides that he will do no more than he is paid for doing is usually so much afraid that he will be cheated that he makes himself safe by doing less than he honestly should.—*F. L. Johnson, in The Roller Mill.*

Personal.

The editor would like to receive the full address of Frank Greiner.

George Whiting, who has been long associated with the Scully Steel & Iron Company, of Chicago, has resigned to engage in business for himself under firm name of Geo. Whiting Company, 428 to 448 N. Halsted street, Chicago, Ill., for the manufacture of all kinds punching and shearing machines and bending rolls.

W. M. McFarland, acting vice-president of the Westinghouse Electric & Manufacturing Company, will deliver a lecture on "Electric Power Distribution in Manufacturing" at Cornell University on Friday, May 9. The several different systems of distribution and their relative advantages will be discussed and the manner of applying electric motors to machinery will be illustrated by a large collection of stereopticon views.

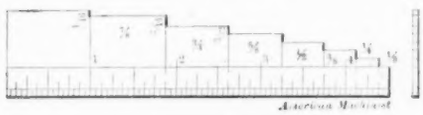
Obituary.

Francis Cadwalader Dade, retired Chief Engineer in the United States Navy, died April 22, seventy-three years old. He entered the navy in 1849, and became Chief Engineer in 1861, being in active service all through the Civil War and retiring in 1889 after forty years of continuous service.

Some New Things.

MACHINIST'S SCALE.

The cut shows an improved scale recently patented by Albert E. Ayer, of East Boston, Mass. This scale, which has one edge graduated in the usual manner, has upon its opposite edge a series of

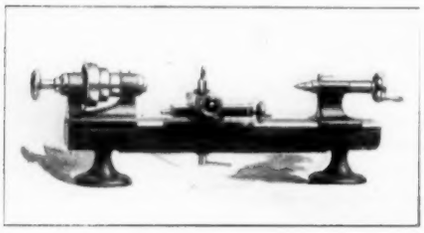


MACHINIST'S SCALE.

steps. These steps run from 1 inch in length down to ⅛ inch, varying by eighths, thus forming a set of standard length gages. Any machinist will readily see a variety of uses to which the scale can be put.

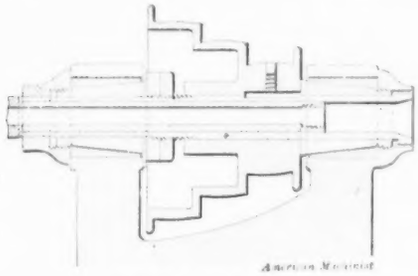
BENCH LATHE.

The accompanying illustrations show a new bench lathe made by the Fenn-Sadler Machine Company, of Hartford, Conn. The half-tone, Fig. 1, gives a good idea



BENCH LATHE.

of the machine as a whole; Fig. 2 is a sectional view through the headstock showing construction of spindle, bearings, etc. The lathe has a bed 32 inches long, will take in work between centers 18 inches long and will swing 7 inches. The spindle which is fitted with drawback collets will take in rods up to ½ inch diameter. The compound rest has a travel of 6 inches in one direction and 2 inches in the other. The headstock is bored out straight and fitted with cast-iron bushings tapered inside. In these bushings fit special composition metal boxes, a nut at the end of



BENCH LATHE HEAD.

each box drawing it into place. The end motion of the spindle is taken up by the two nuts shown just in front of the rear bearing. The countershaft furnished with this lathe can be hung on wall or ceiling, as desired.

LATHE DOG FOR HEAVY CUTS.

The heavier and stronger lathes which are coming into use, particularly for the use of the new high-speed steels with heavy cuts, seem to call also for stronger and heavier lathe dogs, and to meet this

LATHE DOG FOR HEAVY WORK.

demand is the object of the dog shown herewith, which is of drop-forged steel. It is designed to carry the heaviest cuts that can be taken with the modern high-pressure lathes and is made by the Billings & Spencer Company, Hartford, Conn.

We have received from David Ross, secretary of the Bureau of Labor Statistics of the State of Illinois, the Eleventh Biennial Report of the Bureau, covering the year 1900. It contains a great mass of valuable statistics as to the capital, output, etc., of the manufacturing industries of the State, number of employees, regularity of employment, wages, etc. The machinery industry is a distinct class running through the tables. Part II of the book is devoted to a consideration of kindergartens, manual training, etc. The volume is 5¾x8½ inches and contains 282 pages.

We are favored with a pamphlet reprint of an article by our contributor, Wm. H. Booth, of London, entitled "Our Dangerous Navy Boilers." The article was originally written for an English journal and deals with the questions and the discussion caused some time ago by the use of the Belleville boiler in the British Navy. Those interested may, we presume, obtain a copy of this paper by addressing Mr. Booth, care of Ludwig Loewe & Co., 30 Farringdon Road, London.

The Automobile Magazine for May has for its leading article an account of King Edward's Daimler automobile and a picture of the King seated in it. The machine was built in Coventry, England, where, the article states, he is now having another car built which will represent the best possible design and construction.

Commercial Review.

NEW YORK, Monday, May 5.

TOOL MARKET AND OTHER NOTES.

May first has passed with little in the nature of labor troubles to affect the local machine-tool situation. Strikes have taken place in other industries, but machine shops have practically escaped. It is true that in Worcester the crisis has merely been deferred until the 20th inst., but, lacking general interest in the subject throughout the country there is little reason to apprehend a serious disturbance of the market equilibrium during the present season. Meanwhile business in this quarter continues to be excellent with some hint of slackening in a few reports, but with no great amount of change on the average.

There is some talk of higher prices in machine-tool lines, and in some instances advances are said to have been made at a comparatively recent date, but general steadiness governs. A tool man recently from the tool markets as far south as Baltimore finds trade slack in that direction. A report in New York as to wood-working machinery denotes some falling off of inquiry and an increasing reluctance to close contracts.

The large machinery and tool-building companies evidence their belief in the duration of prosperity by a continual expansion of shop facilities. One of the most interesting moves in this direction is the construction of two additions which will be built at the Pratt & Whitney Company's works in Hartford, Conn. This is causing some satisfaction in that town, as it shows that Niles-Bement-Pond Company does not intend to remove the business from there, but rather to develop it where it is. One of the buildings is to be an 80x125-foot, four-story addition to the small-tool department, giving 40,000 square feet of further floor space. Another improvement is contemplated, which it is understood will be used in the larger lines of manufacture. Between the No. 1 and No. 3 buildings running parallel with the Park River, three additional stories will be built, increasing the floor surface by 30,000 square feet. This will be equipped with electric traveling cranes on the first and second stories, with electric elevators and air heating. The new buildings will cost about $100,000, exclusive of their tool equipment.

The contemplated new buildings of the International Steam Pump Company are among the biggest enterprises now on foot, constituting probably, next to the Allis-Chalmers shops, the largest new machine shops now projected in the country. While the tool equipment contracts of the Allis-Chalmers Company, being in the West,

do not make much noise in this market, the New York trade may anticipate the fall of some fat plums in the tool contracts for the new pump plant at Harrison, N. J. A map for the new buildings was exhibited in the local town council a few days ago and showed a machine shop, 1006x122 feet, erecting shop 600x122 feet, high-testing shop 150x130 feet, warehouse and shipping departments 400x75 feet, pattern shop and warehouse 550x75 feet, molding machinery building 65x400 feet, main foundry 140x600 feet, cleaning room and brass foundry 60x200 feet, a power house and an office building. The International Steam Pump Company intends also to enlarge its Snow works at Buffalo, N. Y., plans having been filed for a new foundry 132x404 feet, which it proposes to make one of the best equipped in the United States.

Chas. J. Seibert is in the city at present looking for the purchase and equipment of a plant of machinery which is to go to Labrea on the Rio Purus, Brazil, where a municipal lighting and power plant is to be erected. The plant consists of 50 horse-power Harrisburg direct-connected engine, C & C generator and a B. & W. cross-drum boiler. General Electric direct-current arc lamps will be used. There will be also a C & C motor and triplex pump for municipal water supply. It is intended also to install a searchlight to be used at night in loading rubber. Mr. Seibert thinks that that country is capable of very great improvement, but there is there an opposition to foreigners which retards the country, as apparently foreigners are the only ones that are disposed to go ahead and do anything with the natural resources of the country, the natives being neither inclined to do anything with them themselves nor to permit foreigners to do so. He says the climate is favorable. He has had not a single day's sickness during the ten months of his stay there. As regards the machinery best adapted for that country, he thinks simplicity is the prime requisite, and instances self-contained engines having a single oil cup with a forced distribution of oil that work well simply because it is necessary only to fill this one oil cup, but other engines equally good in every other respect, are continually breaking down and going wrong simply because there is a multiplicity of oil cups, all of which require attention which they cannot get from native help.

Two years and a half ago we published an account of the American machinery business in Yokohama and other cities of the Far East, of F. W. Horne, who was then on a visit to this country and through whom orders had been placed for a large quantity of equipment for the marine machine shop of the Chinese & Eastern Railway at Port Arthur. Mr. Horne is again in America, having arrived by way of Vancouver, B. C. Pending more direct information which we hope to secure when he arrives in the East, it may be interesting to state the substance of an interview with him at Vancouver: He is quoted as having stated that after stern competition with British firms he has received the contract for all interior fittings and supplies for fifteen cruisers ordered by the insular government at Manila from Chinese and Japanese shipbuilding firms [?]. These goods will be purchased in Cincinnati and other Eastern cities of the United States. He also succeeded in getting the contract for supplying the machinery for a Japanese arsenal at Myadzamalon, on the west coast of Japan. These goods will come mostly from Cincinnati. He says that American machinery and ship appointments and supplies are fast winning the preference in the Oriental markets, and the trade in American machinery is increasing year by year in a marvelous degree.

It transpires that Russia's attempts at building locomotives for herself are not going to kill the market in that country for American ones, after all. According to advices just received in Philadelphia, the twenty-four recently built by the Charkoff works for the Central Russian Railways have proven useless, their maximum speed being only 18 miles an hour instead of 50, as provided for in the contract. If all the circumstances were known probably they would be less to the discredit of the engines than this bare statement would imply, for it is hardly credible that these locomotives are incapable of running more than 18 miles an hour under any conditions whatever, but at all events the results seem to have been regarded as quite unsatisfactory for the additional information is vouchsafed that the Russian Government Railway Advisory Board recommends to buy abroad in the future. The Baldwin Locomotive Works have been building locomotives for Russia for thirty years past, having constructed 419 in all, receiving therefor an aggregate of between $6,000,000 and $7,000,000. It is highly probable, therefore, that orders will continue to be placed freely on this side of the Atlantic.

The J. A. Fay & Egan Company has recently received an order for $6,000 or $8,000 worth of wood-working machines, chiefly of large size, to go to South America. It exemplifies the steadiness of prices during the past year to mention that the figures made on this outfit were originally named last June and upon the recent revival of negotiations the former estimate was permitted to stand.

The Abner Doble Company, engineers, San Francisco, Cal., established 1850, writes us that it is preparing plans to make extensive improvements and additions to its works during the year and that it will be in the market for some very large machine tools, all of which must be equipped for electrical drive. Among these will be a 72-inch planer of heavy pattern, with 16-foot table.

There has been ordered for the Illinois Steel Company, which a few years ago was one of the chief steel-making concerns of the country and which has since become a part of the Federal Steel Company, which in turn has become a part of the United States Steel Corporation, a 30x60 x48-inch Westinghouse cross-compound engine.

Among the recent transactions in machine and other tools have been a lot which Westinghouse, Church, Kerr & Co. have ordered from various quarters for construction work, etc., on the Lackawanna & Wyoming Valley Railroad, Scranton, Pa. The outfit was not of very great magnitude, but the local trade spent a good deal of energy in trying to get bites of it. It is this avidity for orders which is offered as an argument where one is disposed to take a lugubrious view of business conditions, but we do not know that the tendency is more prevalent than ordinarily.

The Homestead & Mifflin Street Railway Company has recently begun the construction of a line running from Homestead, Pa. The Laclede Car Company, of St. Louis, has been awarded the contract for the cars. Westinghouse motors will be used and the cars will be equipped with the Westinghouse magnetic brake.

The Hyatt Roller Bearing Company, Harrison, N. J., has met with a demand for its product which has entirely outgrown present facilities. Consequently, plans are being prepared for a modern shop to be erected on the property adjoining the present plant. The building will be 50x200, two stories high. The above shop is but part of the improvements which are contemplated in order to take care of their increasing trade, both home and abroad.

A 2,000 horse-power Allis engine and a battery of National water-tube boilers are understood to be under contract for big works that are to be erected at Bessemer, Ala., by the newly incorporated Standard Fertilizer Company, for the manufacture of fertilizer, hydraulic cement, sulphuric acid, chemical spray, "Thomas meal," and "Brainite meal" from slag. The company was organized by Capt. John C. Brain, who invented the process for making hydraulic cement from slag. The AMERICAN MACHINIST referred to the enterprise in its earlier stages many months ago. The office of the company is in the Mayberry Building, Birmingham, Ala. Included in the equipment of the new plant will be 26 Clark mills.

The Hoefinghoff & Laue Foundry Company, Cincinnati, Ohio, have installed a new 15-ton, 50-foot span, three-motor electric traveling crane, manufactured by the Northern Engineering Works, Detroit, Mich.

The Sprague Electric Company has been awarded the contract for furnishing all the electric motors and generators to be used in the cement works at Hannibal, Mo. The order was given by the Atlas

Portland Cement Company, and the equipment consists of three 400-kilowatt engine type split pole generators and over seventy motors, ranging in sizes from 15 horse-power to 125 horse-power.

The C & C Electric Company has booked a greater run of orders since the first of the year than ever before and its books now make a record-breaking showing. There have lately been noteworthy sales of vertical motors for driving big vertical fans, pumps, etc., orders being now on hand for twenty, ranging from 15 to 40 horse-power. Four of these are to be 20 horse-power motors for running dry-dock pumps of Moran Bros. Co., Seattle, Wash. Six, a little smaller, have already been installed there for that purpose. The C & C Company has also an order on hand for a 50-kilowatt belted generator and ten motors, of 6 to 20 horse-power, to be direct geared or direct belted to machine tools of the Old Dominion Iron & Nail Works Company, Richmond, Va. The Seaboard Realty Company has contracted to take two 60- and six 75-kilowatt C & C generators to go in big apartment houses or hotels in New York city. A sale has been made through an export firm of a 30-kilowatt engine type generator, 5 horse-power pump motor, etc., for Abrams & Co., Manaos, Brazil. The Brooklyn Edison Company has ordered three boosters, each consisting of a 150 horse-power motor direct connected to two 50-kilowatt double commutator generators. The Tietjen & Lang Dry Dock Company, Hoboken, N. J., has ordered the third large motor sold it—a 120 horse-power, series-parallel, double-commutator motor equipment—to operate a line of plunger pumps on a floating dry dock. The C & C Company has many orders for ventilating apparatus for large buildings in New York.

CHICAGO MACHINERY MARKET.

The Chicago representative of a large engine builder, when asked about present trade, picked up a package of cards an inch and a half in thickness and said: "These are the inquiries we have received during the past two days. I doubt if with the time specified we can accept two per cent. of the business." The natural deduction from that remark, that inquiry is large and insistent, finds confirmation from other sellers of power. There is only one report. Business is everywhere excellent. That condition applies to the largest units of Corliss and to the smallest gas and gasoline engines. Boilers are in much the same condition, though there are statements that prices are not always well maintained. Manufacturers whose own trade is taxing their capacities are sometimes surprised to learn their quotations are underbid by a good wide margin, and better time offered also.

The most momentous developments are probably among the iron and steel works. Demand for blowing engines from this source is quite heavy. Power is wanted for blast furnaces at a number of lake cities and in the Pittsburgh region. It is currently reported that the United States Steel Corporation will expend $10,000,000 for machinery, of which two or three million dollars' worth will probably come to Chicago, where the South Chicago plant is to be placed upon the same basis of economical efficiency as the Carnegie works. This entails an extensive substitution and addition of machinery and power.

The Babcock & Wilcox Company has recently sold to the Iroquois Iron Company about 1,500 horse-power boilers to replace old boilers in the furnaces at South Chicago. The Buckeye Engine Company has sold a 400 horse-power engine to the South Chicago Furnace Company. It is reported that the Westinghouse Company has sold the engines for the proposed Deering steel plant at South Chicago. A. L. Ide & Co. have sold two 350 horse-power engines to the Chicago City Railway Company for installation in the new shops at Seventy-ninth street. The Erie City Iron Works have sold two 300 horse-power boilers to the Kingman Plow Company, Peoria, Ill.; two 250 horse-power boilers to the New Orleans Cold Storage & Warehouse Company, New Orleans, and two large boilers to the Hanford Produce Company, Sioux City, Iowa. Alex. Van Siclen & Co. say business is readily taking all the engines they can obtain from factories. The Atlas Engine Works, Indianapolis, are about to build a duplicate boiler plant 1300x70 feet in size. E. L. Gates, of the E. L. Gates Manufacturing Company, says the demand for gasoline engines is excellent and that from all he can learn other sellers of gas and gasoline engines possess the same satisfactory trade.

J. B. Allan, manager of the engine sales department of the Allis-Chalmers Company, says market conditions were never better than now. Large engines are encroaching upon their construction capacity but the demand for units running from, say, 100 to 200 horse-power, is very active. Engines have been sold lately to twenty-five Southern cotton oil plants and about Chicago there is a heavy inquiry for moderately large engines. Other sales include five steeple compound blowing engines to the Carnegie Steel Company, Pittsburgh; one 34x60x60 combined horizontal and vertical, Illinois Steel Co., Joliet plant; one 26x52x48 vertical, Jones & Laughlin, Pittsburgh; one 16x34x36 vertical compound, McCormick Harvesting Machine Company; one 26x58x48 combined horizontal and vertical, Dow Chemical Company, Midland, Mich.; one 26x52x48 horizontal, National Railway Construction Company, Canton, Ohio, etc. etc.

The George Whiting Company, which is the firm name under which George Whiting will manufacture all kinds of punching and shearing machines and bending rolls, is in the market for the following new or second-hand machinery: 36-inch x36-inch x 12-foot planer; universal drill, 5-foot arm; 31-inch swing lathe, 16 feet between centers; 18-inch to 20-inch shaper and a number of small drills and lathes. Portable engine and boiler 20 to 30 horse-power, and also miscellaneous machine-shop equipment. The address of the concern is 428 N. Halsted street, Chicago, Ill.

Quotations.

NEW YORK, Monday, May 5.

Pennsylvania Foundry Pig Iron, Jersey City delivery:

No. 1 X	$20 15 @ $20 65
No. 2 X	19 65 @ 20 15
No. 2 plain	19 15 @ 19 65
Gray forge	18 65 @ 19 15

Alabama Pig, New York delivery:

No. 1 foundry, or soft	19 25 @ 20 25
No. 2 foundry, or soft	18 75 @ 19 75
No. 3 foundry	18 25 @ 19 25
Foundry forge, or No. 4	17 25 @ 18 25

As to prices of Southern irons, see note printed last week.

Bar Iron—Base sizes—Refined brands, mill price on dock 1.93c. in carload lots. Smaller quantities from store, about 2.10c. One local firm has heard a rumor to-day that the mills have advanced prices to 1.90c. Pittsburgh, that is 2.03c. on dock New York, but others inquired of have not heard of such a change.

Tool Steel—Base sizes—Good standard quality, 7c.; extra grades, 10c. and upward.

Machinery Steel—Base sizes—From store, 2.00 @ 2.10c.

Cold Rolled Steel Shafting—Base sizes—From store, 2¾c.

Copper—Lake ingot, 12 @ 12⅛c.; electrolytic and casting, 12⅝ @ 12¾c.

Pig Tin—In 5- and 10-ton lots, f. o. b., New York, 28¼ @ 28½c.

Pig Lead—4.10 @ 4.12½c. in 50-ton lots.

Spelter—4.35c., New York delivery.

Antimony—Cookson's, 10 @ 10¼c., according to quantity upward from one cask; Hallett's, 8c.; various brands, 7¾ @ 8c.

Lard Oil—Prime City, 82 @ 84c.

New Corporations.

Spencer Auto Vehicle Co.; object, dealing in automobiles and other carriages; capital, $200,000; $500 paid in. President, S. L. Larrabee, Portland, Me.

Navigation Safety Co.; object, making and selling nautical instruments; capital, $100,000. President, E. L. Chaney; treasurer, H. H. Edwards, both of Kittery, Me.

Twin Tube Engineering Co.; object, making and dealing in mechanical apparatus, machinery, etc. President, H. L. Cram; treasurer, A. J. Desmond, both of Portland, Me.

Davis Marine Railway & Dock Co.; object, constructing marine railways and docks; capital, $500,000. President, Charles C. Smith, Kittery, Me.; treasurer, Albert E. Knowlton, Malden, Mass.

Remington Metallic Cartridge Co., Orange, N. J.; object, manufacturing explosive cartridges, etc.; capital, $250,000. Incorporators: Eliphalet Remington, Stuart Lindsley and Joseph M. Merrill.

Boston Printing Press Manufacturing Co.;

object, making and dealing in printing presses; capital, $50,000. President, Horace Mitchell, Kittery, Me.; treasurer, A. M. Meloon, New Castle, N. H.

Charles P. Maxwell Foundry Co.; general foundry and manufacturing business; capital, $10,000; $1,000 paid in. President, C. H. Maxwell, Auburn, Me.; treasurer, C. P. Maxwell, West Bowdoin, Me.

Waltham Auto Car Co.; object, making and dealing in automobiles and other carriages; capital, $150,000; $125 paid in. President, S. L. Larrabee, Portland, Me.; treasurer, M. B. King, Waltham, Mass.

The Chattanooga (Tenn.) Bridge Company has been chartered with $100,000 capital stock. The incorporators are William M. Hewitt, G. C. Steward, William C. Burks, A. R. McKenzie and George E. Mattice.

Caldwell Furnace Foundry Co.; principal office, 419 Market street, Camden, N. J.; object, manufacturing furnaces, etc.; capital, $300,000. Incorporators: James W. Caldwell, Curtis F. Johnson, Charles R. Clapp.

Porter Valve & Manufacturing Co.; principal office, 419 Market street, Camden, N. J.; object, manufacturing valves, etc.; capital, $50,000. Incorporators: David W. Porter, S. B. Witherspoon and Herman C. Smith.

Cuyahoga Wire & Fence Co.; principal office, 491 Bloomfield avenue, Montclair, N. J.; object, manufacturing wire rods, etc.; capital, $125,000. Incorporators: Graham Sumner, Edwin B. Goddell and J. Clinton Walker.

Salem Brass & Iron Manufacturing Co.; principal office, 111 Market street, Camden, N. J.; object, manufacturing brass, iron, steel, etc.; capital, $100,000. Incorporators: Harry G. Hart, Edw. Stratton, J. W. Van Meter.

Kent Machine Company, Corporation Trust Co., 15 Exchange place, Jersey City, N. J.; object, manufacturing machines, etc.; capital, $200,000. Incorporators: Wm. S. Walbridge, Henry E. Bodman and Frederick L. Geddes.

United States Cold Rolled Steel & Manufacturing Co.; principal office, 800 Broad street, Newark, N. J.; object, rolling metals; capital, $100,000. Incorporators: Theo. Wagner, Geo. B. Aeschbach and Otto Aeschbach.

Manufacturers.

Philip Goerres, Milwaukee, Wis., will erect a cooperage plant.

The Hapgood Plow Company, Alton, Ill., is building a new foundry.

The Fort Collins (Colo.) Sugar Company will erect a large sugar factory.

A new erecting shop will be built for Joseph Oat & Sons, coppersmiths, Philadelphia, Pa.

A new iron foundry will be built at the scales works of Jones, of Binghamton, N. Y.

Plans for the extension of the Canadian Pacific shops at Winnipeg are being discussed.

Holden, Leonard & Co., manufacturers of woolens, Bennington, Vt., will build an addition.

Plans have been prepared for a new factory of the New England Enameling Company.

The Fulton Iron & Engine Works, Detroit, Mich., have commenced erecting a factory addition.

Excavations have been begun for new buildings of the Marston Worsted Mills, Skowhegan, Me.

F. A. & O. T. Inman, manufacturers of yarns, Bridgeton, R. I., are preparing to erect a new mill.

The Machias Lumber Company, Boston, Mass., will build a new mill at Machias, Me., this summer.

The A. G. Dewey Company, satinet manufacturer, Quechee, Vt., is building an addition to its factory.

The mills of the Tyler Tube & Pipe Works, at Washington, Pa., will, it is reported, be enlarged shortly.

The Harrisburg (Pa.) Pipe & Pipe Bending Company is about to expend $30,000 in additions to its plant.

The Mossberg Wrench Company, Attleboro, Mass., will remove to Providence, R. I., and build a factory there.

Wm. Lapworth & Sons, manufacturers of elastic fabrics, Milford, Mass., are having a new building fitted up.

Plans have been prepared for a factory to be built for the Cream City Woven Wire Works, Milwaukee, Wis.

The box factory of John D. Putnam, wood turner, Webster, Mass., has been burned, with valuable machinery, etc.

A new building is being erected at Syracuse, N. Y., by Oliver M. Edwards for the manufacture of window fixtures.

The Southern Pacific Company will shortly start work on a new boiler and blacksmith shop, etc., at Portland, Ore.

The mill of the Albert Lewis Lumber Company at Stull, Pa., has been burned. It may be rebuilt on a larger scale.

The Cedar Rapids Pump Company, Cedar Rapids, Ia., has decided to erect a 72x58-foot addition to its present foundry.

The Baldwin Iron & Steel Works, Ltd., Ottawa, Ont., are building an addition to their foundry and machine shop.

Plans have been prepared for a new factory building, about 60x100 feet, for the Abrasive Material Company, Philadelphia, Pa.

The Deering Harvesting Company, of Chicago, has offered to locate a branch factory in Hamilton, Ont., for a bonus of $50,000.

Clarence M. Kemp, manufacturer of plumbers' specialties, Baltimore, Md., has acquired land on which he will erect new buildings.

An Allegheny (Pa.) building permit has been issued to the Pittsburgh Clay Pot Company for a four-story factory, to cost $22,000.

A new factory building is to be erected for the Harmon-Whitmore Company, manufacturer of flour mill machinery, Jackson, Mich.

The Federal Construction Company, of Media, Pa., has purchased a site for the manufacture of cream separators and other dairy utensils.

S. W. Booth, of the Booth Manufacturing Company, Detroit, Mich., porch columns and builders' supplies, will erect a factory in Toledo, O.

Work is about beginning on a new building at Syracuse, N. Y., in connection with the factory of the Smith Premier Typewriter Company.

The International Paper Company, New York city, expects to improve its paper and pulp mill at Corinth, N. Y., adding new pulp grinders, etc.

E. C. Stearns & Co., manufacturers of hardware specialties, Syracuse, N. Y., have under construction a molding room, 43x55 feet, nearly ready for use.

The A. B. See Elevator Company (New York office, St. Paul Building), whose factory has been in Brooklyn, will move its plant to Jersey City, N. J.

Plans have been prepared for a new factory building to be occupied by the Chain Belt Company, which is now located at 766 Park street, Milwaukee, Wis.

The Thomas Manufacturing Company, Springeld, O., has recently gone into the grain drill field and proposes to erect and equip a factory doubling the present facilities.

We learn from J. P. Mitchell, Clay Center, Kan., that he has opened a very modern machine shop at that place for repairing threshing engines and other farm machinery.

It is rumored that the Empire Portland Cement Company has decided to rebuild on a larger scale its plant at Warner, N. Y., which was destroyed by fire during the winter.

George C. Bell, La Crosse, Wis., will open a factory there for the manufacture of gasoline engines and electrical supplies. The machinery for the new plant has been ordered.

A permit has been given to J. V. N. Yates to construct a four-story brick power block, 100x132 feet, at Nos. 65 to 79 Lake street, Cleveland, O. The building is to cost $30,000.

The Hampton Company, cotton manufacturer, Easthampton, Mass., will add another story to its mill and a new engine-house will be built to contain a 350 horse-power engine.

The capital stock of the Brookside Cotton Mills, of Knoxville, Tenn., is to be increased from $500,000 to $1,000,000 and the mills' capacity enlarged from 30,000 to 60,000 spindles.

The Sanquoit Silk Manufacturing Company, which is now located at Fifth street and Columbia avenue, Philadelphia, Pa., has bought a site for a new mill and is expected to build in a few months.

Strong, Hewat & Co., North Adams, Mass., proprietors of the woolen mill at Briggsville, have in preparation plans for an addition, although it has not been announced how soon they intend to build.

The contract has been awarded for the superstructure of five of the new Great Northern shop buildings in St. Paul, Minn. The machine shop will be 600x150 feet, and 50 feet high, costing $80,000.

A factory is to be built for J. W. Crawford & Co., at the northeast corner of Glenwood and Allegheny avenues, Philadelphia, Pa. It is to be used for the manufacture of iron bedsteads and specialties.

It is stated unofficially that the Nova Scotia Steel & Coal Company, Ltd., of New Glasgow, N. S., will extend its works at Trenton, N. S., for the manufacture of wooden box and later steel cars.

H. L. Slauson, of Waterbury, Conn., wishes to establish a plant in the Middle West to manufacture the asbestoline, non-rustable stove pipe and other sheet metal work, of which he is the inventor.

Plans are being made for another addition to the plant of the Bridgeport (Conn.) Deoxidized Bronze & Metal Company. The main foundry is to be lengthened and provision made for a traveling crane.

N. Bosch and John C. DeBruyn, of the Valley City Machine Works, manufacturers of wood-working machinery, Grand Rapids, Mich., have purchased a lot and are considering the erection of a plant thereon.

A. G. Butler, pattern letters for iron and brass castings, leather fillet, etc., has removed from 101 Beekman street, New York city, to the Commonwealth Building, 284 Pearl street, corner Beekman.

An oil mill, and probably a fertilizer factory later, will be built at Courtland, Ala. T. W. Pratt, of Huntsville, Ala., promoted the movement, and H. D. Bynum, of Courtland, will probably be elected manager.

Moses H. and Caesar Cone intend to build a colored cotton goods mill at or near Greensboro, N. C., having 100,000 spindles and 4,000 looms. These men manage the Proximity and Revolution mills, near Greensboro.

Wilson Bros. & Co., architects and engineers, Phaildelphia, Pa., have finished plans and invited estimates for a new valve house and boiler-room at the Germantown Station of the United Gas Improvement Company.

Dr. D. G. Pickett, of Fredonia, N. Y., owns the water rights of Arkwright Falls and proposes establishing an electric generating plant and transmitting power to Dunkirk manufactories, including the locomotive works.

Plans have been prepared by the Carnegie Company's engineers for two new furnaces to be erected at the Edgar Thomson steel plant in Braddock. Enlargements to the foundry at the plant necessitate the new furnaces.

Foundations are about completed for an addition to the factory of Crandall, Stone & Co., manufacturers of carriage hardware and golf goods, Binghamton, N. Y. It will cost about $20,000 and will be used as a machine shop.

The sawmill of the H. M. Loud's Sons Company at Munising, Mich., has been sold to Brown & Moore Company, of Marinette, Wis. The new owners wil install larger boilers and engines, and perhaps new shingle machinery, etc.

L. Schwab, of the Schwab Safe Manufacturing Company (foundry, and safe and stove factory), Fostoria, O., who has also interests in a Cincinnati company, will erect a factory at Toledo, O. The building will be 50x300 feet.

It is stated from Worcester, Md., that Thomas J. Whaley will erect a manufacturing plant at Berlin, Md. He proposes to combine in it a hub, spoke and rim factory, saw and planing mill and general wood-working establishment.

The Ham & Nott Manufacturing Company, of Brantford, Ont., manufacturer of refrigerators, etc., will spend $9,000 in enlarging its plant. The new buildings will consist of a workshop, a machine shop and addition to the engine-room.

A five-story factory building, 48x100 feet, will be built at 61-63 Erie street, Chicago, Ill., for C. E. Umbach, at a cost of $40,000. The structure is already under lease to R. Williamson & Co., manufacturers of gas and electric fixtures.

Estimates, plans and specifications are being prepared for enlarging the Vicksburg, Shreveport & Pacific shops at Monroe, La., and for better equipment. The shops will then go regularly into the business of making cars for the road.

The North Jersey Street Railway Company will build an additional power-house in Newark, N. J. Estimates are in the committee's hands not only for the building but for the extra dynamos and engines. The new station will supply 10,000 horse-power.

There is what appears to be a well-founded report that the United States Steel Corporation is to build a $10,000,000 or $15,000,000 steel tube plant at Lorain, O., to employ 8,000 men. It seems to be instead of the one said to have been proposed for Conneaut, O.

A. L. Hayes, of Erin, Tenn., is one of the incorporators of the A. L. Hayes Company, and states that the company will have erected on ground recently purchased in East Nashville a stave factory, to cost $10,000. Cooperage works will be added later.

The Oakland Woolen Company has been organized in Oakland, Me., to erect a $70,000 mill. William M. Ayer is president; George W. Goulding, vice-president; William T. Haines, of Waterville, clerk and treasurer; George W. Taylor, general manager.

A franchise has been granted by the city of St. Paul, Minn., to F. B. Brace, George H. Schellenberger and F. C. Genge to furnish electric power in the Tenth and Eleventh wards. A plant will be built in a central position among the factories in the Transfer district.

Capitalists at Sharon, Pa., and Youngstown, O., are organizing a corporation for the purpose of erecting an open hearth steel plant. W. E. Taylor, who retired recently as general manager of the Republic Iron & Steel Company, will, it is said, be connected with the enterprise.

A spool manufactory will be opened in Lewiston, Me., in the late fall or early winter. A company has been incorporated, the president being John L. Fiske, Cambridge, Mass.; treasurer, Warren M. Hill, Boston. The company has bought the patent for spool making of J. W. Carver.

The Southern Sewer Pipe Company has been incorporated and will build a plant on the Birmingham (Ala.) district for the manufacture of clay products. The president and general manager is S. L. Russell, of New York; secretary and treasurer, J. A. Menge, of New Orleans.

The Fred M. Prescott Steam Pump Company's new foundry at West Allis, Wis., has been placed in operation recently. The first metal to be cast was run into a small souvenir paper-weight labeled "First metal cast in West Allis," and which Mr. Prescott is distributing among his friends.

The Railway Steel Casting Company, a newly organized corporation, has purchased 20 acres of ground at Tarentum, Pa. Five or six buildings will be erected, the main one being 340x140 feet. The company will manufacture finished and unfinished steel forgings, producing 1,000 tons a month.

John D. Dwyer, Birmingham, Ala., proposes to organize a company to erect a rolling mill to manufacture structural steel and iron and larger plates and bars than are being made in that region. M. H. Smith, president of the Louisville & Nashville Railroad Company, may be interested in the company.

A cereal company has been organized to build a plant in Warren, O. The company embraces J. N. Neal and H. I. Milnes, of Coldwater, Mich., and George B. Devoe, Jules Vautrot, W. S. Kernohan and W. G. Lamb, of Warren. Mr. Milnes will be general manager, and the company will employ 300 men.

The Kuenzel Non-Asphyxiating, Non-Explosive Crude Oil Gas Producing & Heating Company has filed articles of incorporation, and will locate its plant in Hudson County, N. J. The principal office is at 260 Eleventh street, Hoboken, and is in charge of Charles A. Kuenzel, the inventor of the process.

The Southern Foundry & Machine Works, Fredericksburg, Va., have just closed a deal with W. L. Dempsey for the sole right to manufacture the Dempsey Universal Harrow. It is also contemplated to introduce other lines of manufacture which will enlarge the plant and increase the number of operatives.

Two new steel plants are in prospect for Wilmington, Del. The Baltimore Rolling Mill Company, in which Charles G. Phillips, of Wilmington, is interested, will locate its plant either in Wilmington or Baltimore, and the Delaware Forge & Steel Company has ground in Wilmington, upon which it intends to build.

Peter Lyall & Sons, contractors, Montreal, P. Q., have closed a contract with the Sturgeon Falls Pulp & Paper Company for the development of the water power and the erection of the buildings required for the large mills at Sturgeon Falls, Ont. G. H. Hardy, of New York, is architect and mill engineer for the company.

The South Framingham Industrial Association, composed mostly of members of the Framingham Board of Trade, has awarded the contract for the construction of a foundry building to Alderman T. P. Hurley, of Marlboro. The building will be 120x78 feet and will, it is understood, be used as an iron foundry by a Mr. Fenton.

The Nicholas Dryer Company has been incorporated in Ohio with a capital of $300,000 for the manufacture of dry kilns. The incorporators were O. H. L. Wernicke, James E. Blaine, H. C. Yeiser, Fred W. Tobey and George S. Baily. The plant of the new enterprise will be located in Norwood, near the Globe-Wernicke Company's plant.

A brass factory is to be started at Ogdensburg, N. Y., by the W. H. Linton Company, Inc., of Providence, R. I., manufacturing brass and steel, brass plated sash, curtain and drapery and drapery extension rods, also running an electro-plating plant for work in brass and silver plating. The machinery has been shipped from the plant in Providence.

The Utica Pipe Foundry Company has let the contract for a material enlargement of its plant. An addition, 85x46 feet, will be built to the molding room. It will be fitted with a 30-ton electric traveling crane. The other new building will be a machine shop, 152x52 feet. It will have a 15-ton traveling crane. Machinery will be put in for facing and drilling flanges and fittings.

The Chamber of Commerce, Muskegon, Mich., announces that a contract has been closed with the Superior Manufacturing Company, of Chicago, Ill., to come to Muskegon. M. A. Donahue and three sons, of Chicago, are prominent stockholders. The concern will manufacture school desks, furniture and supplies. The new factory building is to be three stories, 66x140 feet, with a power-house, 66x46½ feet, and a dry-kiln building, 40x80 feet.

The Minster Machine Company, Minster, O., is making improvements to its plant. A spacious building is being erected for a foundry, which is being equipped with pulley molding machines and other modern machinery. Pulley finishing machines are also being added, and the entire plant is expected to be in full operation within a few weeks. In the future the company will devote its entire time to the manufacture of friction clutches and plain pulleys.

A new shop will be built at Springfield, O., by the Kelly Springfield Road Roller Company. This company has been incorporated with a capital stock of $125,000 by Hon. O. S. Kelly, O. W. Kelly, G. L. Kelly, J. B. Cartmell and J. E. Bowman. The incorporation was for the purpose of separating the piano plate and road roller business of the O. S. Kelly Company (manufacturer of threshers also), which is now employing nearly 500 men, and is cramped for space.

Harron, Rickard & McCone (Inc.), San Francisco, Cal., have purchased the machinery and agencies of Parke & Lacy Company. J. O. Harron and Thos. Rickard, long associated with Parke & Lacy Company, are respectively the president and first vice-president of the new company, and the second vice-president is A. J. McCone, proprietor of the Fulton Foundry, Virginia City, Nevada. In addition to lines of mining, milling, woodworking and iron-working machinery, it is the company's intention to carry a large stock of electric generators, motors and other electrical appliances. They will undertake the complete installation of mining, cyaniding, steam, pumping and hoisting plants.

Miscellaneous Wants.

Advertisements will be inserted under this head at 25 cents a line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Gear Wheels, gear cutting. Grant; see p. 18.

Punches & dies. Wal.M.Wks., Waltham, Mass.

Caliper cat. free. E. G. Smith, Columbia, Pa.

Patterns and models. 19 Thames st., N. Y.

Ohio Township Officers Directory for 1902, now ready. R. S. Strader, Columbus, O.

Will buy or pay royalty for good patented machine or tool. Box 282, AMER. MACH.

Wanted—Improvements in grinding machinery. Address Box 1435, Providence, R. I.

Fine machine and experimental work. The Des Jardins Type Justifier Co., Hartford, Ct.

Light and fine mach'y to order; models and elec. work specialty. E. O. Chase, Newark, N. J.

Light machine & experimental work; models made. S. Messerer, 15 Springf. av., Newark, N.J.

For Sale—One 4 H.-P. Webster gas engine; good condition; bargain to quick buyer. Address A. K. Bowman, Greensburg, Pa.

Purchaser for complete sets of universal radial and plain upright drill patterns with drawings; for sale cheap. Address "Patterns," care AMERICAN MACHINIST.

Machinery designed, mechanical drawings, blueprints, plans for power-houses, power transmission; 20 years' experience. "Engineer and Draftsman," Box 344, AM. MACH.

An iron manufacturing company, employing 100 hands (mostly skilled) the year round, contemplates removal and should be pleased to receive propositions on change of location. Address Box X, AMERICAN MACHINIST.

Purchaser for small manufacturing plant in Madison, Wis.; lot, 100x180 feet; machine shop, 32x68, two story, with line shaft and gasoline power; foundry, 40x54, new modern equipment; good location; for sale cheap. Hart-Parr Co., Charles City, Iowa.

For Sale, Cheap—Two colored tool tempering charts, explaining all tempering to a standard, in oil, water or tallow, making all tools with hard, tough edge, and 40 new steel-working receipts; all for $1. W. M. Toy, Sidney, O. (40 years a factory steel worker).

I want a partner to manufacture, or will sell territory rights in the only fire-escape ever patented which can be carried in traveler's pocket, instantly attached to any window, lower a whole family, including apparatus, 75 feet in 3 minutes. Address J. A. Hoyt, Schenectady, N. Y.

Wants.

Situation and Help Advertisements only inserted under this head. Rate 25 cents a line for each insertion. About six words make a line. No advertisements under two lines accepted, and no advertisements abbreviated. The cash and copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded. Applicants may specify names to which their replies are not to be forwarded; but replies will not be returned. If not forwarded they will be destroyed without notice. Original letters of recommendation or other papers of value should not be enclosed to unknown correspondents.

Situations Wanted.

Draftsman, mechanical, 12 years' experience, desires position. Box 406, AM. MACH.

Draftsman on engine work, or as engineer's assistant. Box 452, AMERICAN MACHINIST.

Mechanical draftsman, experienced on turbines, wishes position. Box 449, AM. MACH.

Draftsman, graduate, 3 years' experience; engine or tool work preferred. Box 465, A. M.

Mechanical draftsman, experienced on cranes, wishes position. Box 430, AM. MACH.

Mechanical draftsman, experienced designer, wants position near New York. Box 431, AMERICAN MACHINIST.

Position of responsibility, by competent machine shop and toolroom foreman. Box 450, AMERICAN MACHINIST.

Draftsman with shop experience, now in charge of drawing room, desires change of location. Box 443, AMERICAN MACHINIST.

A1 brass foundry foreman desires to change position; proficient mixer; capable manager of men; modern methods. Box 444, AM. M.

Draftsman and designer wants to make a change; long shop experience on experimental work; high-class references. Box 453, A. M.

A position of some responsibility, by an experienced mechanical draftsman, designer and mechanic; capable of taking charge. Box 461, AMERICAN MACHINIST.

Wanted—A position as mechanical engineer or assistant, by a university graduate and machinist, experienced in drafting. Box 426, AMERICAN MACHINIST.

Mechanical draftsman, technical graduate, 5 years' experience in general machine pump and compressor works, desires change. Box 457, AMERICAN MACHINIST.

Tool designer wants position; expert at designing tools, jigs, fixtures, etc., for reducing the cost of manufactured articles. Wm. H. Flood, 308 W. 123d st., New York City.

Energetic, ambitious young draftsman desires change, with good chances for advancement by working; New England preferred. "Studious," care AMERICAN MACHINIST.

Cost accountant, experienced, up to date, wide awake, competent, executive ability, will systematize new firm; mean business; investigate. Box 463, AMERICAN MACHINIST.

An erecting engineer, 25 years' experience with general machinery, desires position as master mechanic of mill or factory; best references given. Box 420, AMER. MACH.

Mechanical engineer, graduate draftsman, design or erect high-speed engines, boilers, refrigerating plants; American and foreign experience. Box 458, AMERICAN MACHINIST.

A position as instructor in machine shop practice, by a practical man who has had experience in teaching; the best of references as to ability. Box 456, AMERICAN MACHINIST.

A machinist with 10 years' experience, and who is a good lathe hand, wishes situation in a general repair and engine shop; principally on floor work. Address Box 464, AM. MACH.

Mechanical draftsman, 20 years' experience designing tools, jigs, fixtures and light automatic machinery, desires change, in or near New York city; references. Box 446, AM. M.

Position as assistant superintendent, by a technical and practical mechanical engineer; experienced in modern methods, organizing and handling men to obtain good results. Box 445, care AMERICAN MACHINIST.

Position as superintendent or foreman, by practical mechanic, up to date in modern methods, organizing and the handling of men to obtain best results; interchangeable machinery and specialties. Box 348, AM. M.

Machinist and toolmaker, experienced drafting, handling help, developing ideas, wants position of some responsibility or drafting; vicinity of New York; 30 years old; best references. Box 451, AMERICAN MACHINIST.

Mechanical engineer and first-class designer desires a position in New York, Jersey City or vicinity; 20 years' experience in different lines; anything about engines and power plants, etc; excellent testimonials. Box 459, AMERICAN MACHINIST.

Foreman desires position of responsibility with manufacturing concern, where a wide-awake young man with a successful experience on special and automatic machinery, engines, electrical apparatus, specialties and tools for interchangeable work will be appreciated; energetic, capable and up to date in every respect. Box 460, AMERICAN MACHINIST.

Mechanical engineer, widely experienced, inventing and constructing labor-saving, intricate automatic machinery, devising special processes, etc., may be engaged for temporary or permanent work; technical graduate; member A. S. M. E., etc.; advertiser will not work for less than $500 per month, but guarantees satisfaction and results in anything he undertakes. Box 429, AMERICAN MACHINIST.

Help Wanted.

Machinists to sell my calipers, etc.; big inducements. E. G. Smith, Columbia, Pa.

Wanted—Draftsmen, experienced on electrical work. Box 466, AMERICAN MACHINIST.

Wanted—Two good, all-round machinists on crane work. Address Box 440, AM. MACH.

Wanted—A number of good patternmakers. Call or address De Laval Steam Turbine Co., Trenton, N. J.

Draftsmen wanted: one designer, one detail; work, heavy automobiles. Vehicle Equipment Company, Brooklyn, N. Y.

Wanted—Several good patternmakers, by a machine tool manufacturing works in Jersey. Box 179, AMERICAN MACHINIST.

Draftsman with experience in machine tool work; permanent position for right man. Address Box 462, AMERICAN MACHINIST.

Wanted—Mechanical draftsman; give reference; state age, experience and salary. Address Box 448, AMERICAN MACHINIST.

A few first-class milling machine hands; a number of boring mill and lathe hands. Apply Washington and Essex st., Jersey City.

Six first-class molders for Corliss engines and other heavy machine castings. Address "Manufacturer," care AMER. MACHINIST.

Mechanical draftsman; knowledge of crushing and screening machinery and plants required. Box 442, AMERICAN MACHINIST.

A first-class man to erect cutters and bag machinery. Apply, giving experience and wages expected, Box 441, AMER. MACHINIST.

Wanted—Capable and energetic foundry foreman for Eastern shop making heavy castings. Apply, stating salary, to Box 417, A. M.

Wanted—Ten good patternmakers; permanent positions; state wages expected. The Balkwill Pattern Works, 970 Hamilton st., Cleveland, O.

Machinists wanted to act as shop agents and sell small tools where they work. Address E. H. Randall, 235 Woodland ave., Springfield, Ohio.

Wanted—Toolmakers on small interchangeable work in large factory on Staten Island, New York; state experience, references and wages expected. Address Box 467, AM. M.

Wanted—Mechanical draftsmen; permanent position; preferably with experience in gas works construction. Write, stating salary expected, to the Western Gas Construction Company, Fort Wayne, Ind.

Wanted—Thoroughly competent general mechanical and structural draftsman, with considerable experience, for drafting room of large industrial establishment. Address 750 Bourse Building, Philadelphia.

First-class tool and die maker; must understand the laying out of dies; steady position for right party; shop in New York city; state wages and where last employed. Address C. E. D., care AMERICAN MACHINIST.

Mechanical draftsman of experience and ability; must be capable of developing steam plant about to be installed; position permanent for satisfactory man; state age, experience and salary desired. Box 455, AM. M.

We are enlarging our works, and will shortly require an increased number of skilled mechanics; we invite application from pattern makers, molders and machinists. Address the Westinghouse Machine Company, East Pittsburgh, Pa.

Wanted—Draftsman experienced in heavy punching and coping machines, plate rolls, angle shears and other machines for heavy structural material. Address, with proofs of competency and salary expected, B. S. C., care AMERICAN MACHINIST.

Applications invited for position of traveling salesman in air compressor department of large manufacturer in this line; to be located in Chicago. Address, stating age, qualifications and previous experience, "Compressor," Box 444, AMERICAN MACHINIST.

Foreman for small machine shop; one who understands die and other work and is willing to get in and hustle with the rest of the men; good position for the right man; name salary expected and where last employed. Address W. H. S., care AMERICAN MACHINIST.

Draftsman.—Experienced draftsman wanted on tool and fixture designing; men of shop experience preferred; location in Eastern Massachusetts; none but A1 men will be considered. Write, giving exerience, age, salary, etc., to Box 454, AMERICAN MACHINIST.

First-class man who understands boring and drilling and the building of small foot and power presses; good, steady position for the right man; located in New York city; reference required and state salary expected. Address Box X. Y. Z., care AMER. MACHINIST.

Wanted—Thoroughly competent foreman on machine tool building, experienced in building pipe threading machinery, familiar with methods of producing duplicate parts on turret lathes; give age, experience, salary expected and references. Box 237, AMER. MACH.

Wanted—A thoroughly competent foreman for a machine shop of some pretensions; a technical graduate with up-to-date ideas of the most approved machine shop practice preferred; an excellent opportunity near New York for the right man. Address Box 397, AMERICAN MACHINIST.

General manager and mechanical engineer required by a large engineering house negotiating engineering propositions and sales of American machinery in all countries; manager must be well known to American manufacturers and familiar with American machinery; mechanical engineer must be able to act as chief to a board of expert engineers in all lines of engineering. Box 468, AM. M.

Wanted—Superintendent with large experience in handling men in the manufacture of fine, light, complex mechanisms, consisting of interchangeable parts; must be thoroughly experienced in designing dies and special tools of all kinds, and capable of turning out perfect work rapidly and economically; state age, salary expected, experience and addresses of previous employers. Address Felt & Tarrant Mfg. Co., 52 Illinois st., Chicago.

Wanted.—Machinists, toolmakers, draftsmen, do you want to increase your salary? They all say that Saunders' enlarged edition "Hand Book Practical Mechanics" exactly fills the bill for valuable shop kinks, rules, etc., figured out by simple arithmetic and drawings; also most complete reference tables in existence, many taken from note books of best mechanics in the country. Pocket size. Price, post paid, only $1, cloth; $1.25 leather. Agents wanted. Book sells itself. Big money. C. H. Saunders, 216 Purchase st., Boston, Mass.

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Balls, Steel

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Bars, Boring

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Phosphor Bronze Smelting Co., Philadelphia, Pa.
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Belt Dressing

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Am. Tool Wks. Co., Cincinnati, O.
Baush Mach. Tool Co., Springfield, Mass.
Bement, Miles & Co., New York.
Betts Mach. Co., Wilmington, Del.
Bullard Mach. Tool Co., Bridgeport, Conn.
Hill, Clarke & Co., Boston, Mass.
Niles Tool Works Co., New York.
Pond Mach. Tool Co., New York.
Warner & Swasey Co., Cleveland, Ohio.

Carborundum
See Grinding.

Castings, Brass and Bronze
Christensen Engineering Co., Milwaukee, Wis.
Nolte Brass Co., Springfield, O.
Phosphor Bronze Smelting Co., Philadelphia, Pa.

Castings, Die Molded
Franklin Mfg. Co., Syracuse, N. Y.

Castings, Motor
Ferodowill & Co., J. H., St. Paul, Minn.

Castings, Steel
Acme Steel & Mall. Iron Works, Buffalo, N. Y.
Christensen Engineering Co., Milwaukee, Wis.
Uniform Steel Co., Newark, N. J.
U. S. Steel Co., Everett, Mass.

Centers, Planer
Fay & Scott, Dexter, Me.
New Haven Mfg. Co., New Haven, Conn.
Pratt & Whitney Co., Hartford, Conn.
Reed Co., F. E., Worcester, Mass.

Centering Machines
Bement, Miles & Co., New York.
Kempsmith Mfg. Co., Milwaukee, Wis.
Niles Tool Works Co., New York.
Pond Mach. Tool Co., New York.
Whiton Machine Co., D. E., New London, Conn.

Chains, Driving
Automobile & Cycle Parts Co., Cleveland, O.
Boston Gear Works, Boston, Mass.
Jeffrey Mfg. Co., The, Columbus, Ohio.
Link Belt Engr. Co., Phila., Pa.
Whitney Mfg. Co., Hartford, Ct.

Chucking Machines
Cleveland Mach. Screw Co., Cleveland, O.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
Potter & Johnston Mach. Co., Pawtucket, R. I.
Pratt & Whitney Co., Hartford, Conn.
Reed Co., F. E., Worcester, Mass.
Warner & Swasey Co., Cleveland, Ohio.
Windsor Mach. Co., Windsor, Vt.

Chucks, Drill
Almond, T. R., Brooklyn, N. Y.
Brown & Co., R. H., New Haven, Conn.
Cleveland Twist Drill Co., Cleveland, O.
Goodell-Pratt Co., Greenfield, Mass.
The E. Horton & Sons Co., Windsor Locks, Conn.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Pratt Chuck Co., Frankfort, N. Y.
Standard Tool Co., Cleveland, O.
Trump Bros. Mach. Co., Wilmington, Del.
Whitney Mfg. Co., Hartford, Ct.
Whiton Mach. Co., D. E., New London, Conn.

Chucks, Lathe
Cushman Chuck Co., Hartford, Ct.
Hoggson & Pettis Mfg. Co., New Haven, Conn.
The E. Horton & Sons Co., Windsor Locks, Conn.
Pratt & Whitney Co., Hartford, Conn.
Skinner Chuck Co., New Britain, Conn.
Westcott Chuck Co., Oneida, N. Y.
Whiton Mach. Co., D. E., New London, Conn.

Chucks, Split
Faneuil Watch Tool Co., Boston, Mass.

Clutches, Friction
Caldwell, Son & Co., H. W., Chicago, Ill.
Faneuil Watch Tool Co., Boston, Mass.
Jones Fdry. & Mch. Co., W. A., Chicago, Ill.
New Haven Mfg. Co., New Haven, Conn.
Oesterlein Mach. Co., Cincin., O.
Patterson, Gottfried & Hunter, Ltd., New York.
Pratt & Whitney Co., Hartford, Conn.

Codes
Lieber Code Co., New York.

Compressors, Air
Blanchard Mach. Co., Boston, Mass.
Chicago Pneumatic Tool Co., Chicago, Ill.
Christensen Engineering Co., Milwaukee, Wis.
Clayton Air Compressor Works, New York.
Curtis & Co. Mfg. Co., St. Louis, Mo.
Ingersoll-Sergeant Drill Co., New York.
Rand Drill Co., New York.

Consulting Engineer
Thompson, Hugh L., Waterbury, Conn.

Coping Machines
Long & Allstatter Co., Hamilton, Ohio.

Correspondence Schools
See Schools, Correspondence.

Countershafts
Builders' Iron Fdry., Provi., R. I.
Oesterlein Mach. Co., Cincin., O.
Pratt & Whitney Co., Hartford, Conn.
Reeves Pulley Co., Columbus, Ind.
Wilmarth & Morman Co., Grand Rapids, Mich.

Couplings, Shaft
Cresson Co., Geo. V., Philadel., Pa.
Davis Mach. Co., W. P., Rochester, N. Y.
Jones Fdry. & Mch. Co., W. A., Chicago, Ill.
Patterson, Gottfried & Hunter, Ltd., New York.
Stuart, R. J., New Hamburg, N. Y.

Counting and Printing Wheels
Franklin Mfg. Co., Syracuse, N. Y.
Grant Mfg. & Mach. Co., Bridgeport, Conn.

Cranes
Brown Hoisting Mach. Co., N. Y. City.
Chicago Pneumatic Tool Co., Chicago, Ill.
Cleveland Crane & Car Co., Cleveland, O.

Cranes—*Continued*
Curtis & Co. Mfg. Co., St. Louis, Mo.
Franklin Portable Crane & Hoist Co., Franklin, Pa.
Maris Bros., Philadelphia, Pa.
Moyer & Co., J. W., Philadel., Pa.
Niles-Bement-Pond Co., New York.
Northern Engineering Works, Detroit, Mich.
North Penn. Iron Co., Phila., Pa.
Pawling & Harnischfeger, Milwaukee, Wis.
Sellers & Co., Wm., Philadel., Pa.
Whiting Foundry Equipment Co., Harvey, Ill.

Crank Pin Turning Machines
Underwood & Co., H. B., Philadelphia, Pa.

Cupolas, and Ladles, Foundry
Northern Engr. Works, Detroit, Mich.
Obermayer Co., S., Cincinnati, O.
Whiting Foundry Equip. Co., Harvey, Ill.

Crucibles
Dixon Crucible Co., Jos., Jersey City, N. J.

Cutters, Milling
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Twist Drill Co., Cleveland, O.
Gay & Ward, Athol, Mass.
Ingersoll Milling Mach. Co., Rockford, Ill.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Rogers, John M., Boat, Gage & Drill Works, Gloucetser City, N. J.
Standard Tool Co., Cleveland, O.

Cutting off Machines
Bement, Miles & Co., New York.
Davis Mach. Co., W. P., Rochester, N. Y.
Franklin Mach. Wks., Phila., Pa.
Hurlbut-Rogers Mach. Co., South Sudbury, Mass.
Newton Mach. Tool Wks., Philadelphia, Pa.
Niles Tool Works Co., New York.
Pond Mach. Tool Co., New York.

Cutting off Tools
Armstrong Bros. Tool Co., Chicago, Ill.
Pratt & Whitney Co., Hartford, Conn.

Dies, Sheet Metal
Bliss Co., E. W., Brooklyn, N. Y.
Todeio Mch. & Tool Co., Toledo, Ohio.

Drawing Boards and Tables
Rich, J. & G., Philadelphia, Pa.

Drawing Instruments
Alteneder & Sons, Theo., Philadelphia, Pa.

Drilling Machines, Bench
Barnes Co., W. F. & John, Rockford, Ill.
Pratt & Whitney Co., Hartford, Conn.

Drilling Machines, Boiler
Aurora Tool Works, Aurora, Ind.
Baush Mch. Tool Co., Springfield, Mass.
Bickford Drill & Tool Co., Cincinnati, O.
Bement, Miles & Co., New York.
Dallett & Co., Thos. H., Phila., Pa.
Niles Tool Works Co., New York.
Pond Mach. Tool Co., New York.

Drilling Machines, Multiple Spindle
Baker Bros., Toledo, O.
Barnes Co., B. F., Rockford, Ill.
Barnes Co., W. F. & John, Rockford, Ill.
Baush Mch. Tool Co., Springfield, Mass.
Bement, Miles & Co., New York.
Bickford Drill & Tool Co., Cincinnati, Ohio.
Dallett & Co., Thos. H., Phila., Pa.
Garvin Mach. Co., New York.
Harrington Son & Co., Edwin, Philadelphia, Pa.
Newton Machine Tool Works, Philadelphia, Pa.
Niles Tool Works Co., New York.

Drilling Machines, Portable
Dallett & Co., Thos. H., Phila., Pa.

Drilling Machines, Pneumatic
Chicago Pneumatic Tool Co., Chicago, Ill.
Cleveland Pneu. Tool Co., Cleveland, Ohio.
Phila. Pneumatic Tool Co., Philadelphia, Pa.

Drilling Machines, Radial
Amer. Tool Wks. Co., Cincin., O.
Baush Mch. Tool Co., Springfield, Mass.
Bement, Miles & Co., New York.
Bickford Drill & Tool Co., Cincinnati, Ohio.
Cleveland Punch & Shear Works Co., Cleveland, O.
Dreses Mach. Tool Co., Cincin., O.
Fosdick & Holloway M. T. Co., Cincinnati, O.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Hill, Clarke & Co., Boston, Mass.
Niles Tool Works Co., New York.
Pond Mach. Tool Co., New York.
Reade Mchry Co., Cleveland, O.

Drilling Machines, Turret
Niles Tool Works Co., New York.
Quint, A. D., Hartford, Conn.

Drilling Machines, Upright
Am. Tool Wks. Co., Cincinnati, O.
Aurora Tool Works, Aurora, Ind.
Baker Bros., Toledo, O.
Barnes Co., B. F., Rockford, Ill.
Barnes Co., W. F. & John, Rockford, Ill.
Bement, Miles & Co., New York.
Blaisdell & Co., P., Worcester, Mass.
Cincinnati Mach. Tool Co., Cin., O.
Davis Mach. Co., W. P., Rochester, N. Y.
Fosdick & Holloway Mach. Tool Co., Cincinnati, O.
Gould & Eberhardt, Newark, N. J.
Harrington & Son Co., Edwin, Philadelphia, Pa.
Hill, Clarke & Co., Boston, Mass.
Hoefer Mfg. Co., Freeport, Ill.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
Niles Tool Works Co., New York.
New Haven Mfg. Co., New Haven, Conn.
Pratt & Whitney Co., Hartford, Conn.
Sibley & Ware, South Bend, Ind.
Washburn Shops, Worcester, Mass.

Drills, Center
Pratt & Whitney Co., Hartford, Conn.
Slocomb & Co., J. T., Providence, R. I.

Drills, Rail
Bement, Miles & Co., New York.
Niles Tool Works Co., New York.

Drills, Ratchet
Parker Co., Chas., Meriden, Ct.
Pratt & Whitney Co., Hartford, Conn.

Dynamos
Akron Elec. Mfg. Co., Akron, O.
C & C Electric Co., New York.
Commercial Electric Co., Indianapolis, Ind.
Crocker-Wheeler Electric Co., Ampere, N. J.
Eck Dynamo & Motor Works, Belleville, N. J.
General Elec. Co., New York.
Jantz & Leist Elec. Co., Cincin., O.
Northern Elec. Mfg. Co., Madison, Wis.
Robbins & Myers Co., Springfield, Ohio.
Sprague Elec. Co., New York.
Triumph Elec. Co., Cincinnati, O.
Westinghouse Electric & Mfg. Co., Pittsburgh, Pa.

Electrical Supplies
Akron Elec. Mfg. Co., Akron, O.
Commercial Electric Co., Indianapolis, Ind.
General Elec. Co., New York.
General Incan. Arc Light Co., New York.
Triumph Electric Co., Cincin., O.
Westinghouse Elec. & Mfg. Co., Pittsburgh, Pa.

Elevators
Albro-Clem Elevator Co., Philadelphia, Pa.
Morse, Williams & Co., Phila., Pa.

Emery Wheels
See Grinding Wheels.

Enclosures, Tool-room
Merritt & Co., Philadelphia, Pa.

Engines, Steam
Buffalo Forge Co., Buffalo, N. Y.
Frick Co., Waynesboro, Pa.
Rand Drill Co., New York.

Engine Stop
Consolidated Engine Stop Co., New York.

Engines, Gas and Gasoline
Backus Water Motor Co., Newark, N. J.
Charter Gas Engine Co., Sterling, Ill.
Columbus Mach. Co., Columbus, O.
Foos Gas Eng. Co., Springfield, O.
Maywood Foundry & Mach. Co., Chicago, Ill.
Mietz, August, New York.
New Era Iron Wks., Dayton, O.
Olds Motor Wks., Lansing, Mich.
Patterson, Gottfried & Hunter, Ltd., New York.
Regal Gasoline Engine Co., Coldwater, Mich.
Springfield Gas Eng. Co., Springfield, O.
Struthers, Wells & Co., Warren, Pa.
Weber Gas & Gasoline Eng. Co., Kansas City, Mo.

Fans, Exhaust
Buffalo Forge Co., Buffalo, N. Y.

Fans, Electric
Northern Elec. Mfg. Co., Madison, Wis.
Sprague Elec. Co., New York.
Westinghouse Elec. & Mfg. Co., Pittsburgh, Pa.

Files and Rasps
Barnett Co., G. & H., Phila., Pa.
Hammacher, Schlemmer & Co., New York.
Nicholson File Co., Prov., R. I.
Troy File Works, Troy, N. Y.

Fillers, Oil Can
The Winkley Co., Hartford, Conn.

Fittings, Steam
Crane Co., Chicago, Ill.
Crosby Steam Gage & Valve Co., Boston, Mass.
Jenkins Bros., New York.
Lunkenheimer Co., Cincinnati, O.
Walworth Mfg. Co., Boston, Mass.

Forges
Buffalo Forge Co., Buffalo, N. Y.
Miner & Peck Mfg. Co., New Haven, Conn.

Forgings, Drop
Billings & Spencer Co., Hartford, Conn.
Miner & Peck Mfg. Co., New Haven, Conn.
Williams & Co., J. H., Brooklyn, N. Y.
Wyman & Gordon, Worcester, Mass.

Forgings, Hydraulic
Wyman & Gordon, Worcester, Mass.

Forgings, Steel
Wyman & Gordon, Worcester, Mass.

Foundry Furnishings
Obermayer Co., S., Cincinnati, O.
Whiting Foundry Equip. Co., Harvey, Ill.

Furnaces, Coal, Gas and Oil
Am. Gas Furnace Co., N. Y. City.
Buffalo Forge Co., Buffalo, N. Y.
Chicago Flexible Shaft Co., Chicago, Ill.

Furniture, Machine Shop
New Britain Mach. Co., New Britain, Conn.

Gages, Standard
Brown & Sharpe Mfg. Co., Providence, R. I.
Rogers, John M., Boat, Gage & Drill Works, Gloucester City, N. J.
Sawyer Tool Mfg. Co., Fitchburg, Mass.
Slocomb & Co., J. T., Prov., R. I.
Starrett Co., L. S., Athol, Mass.

Gages, Recording
Bristol Co., Waterbury, Conn.

Gages, Steam
Crosby Steam Gage & Valve Co., Boston, Mass.

Gas Producers
Am. Gas Furnace Co., N. Y. City.

Gear Cutting Machinery
Bickford Drill & Tool Co., Cin., O.
Brown & Sharpe Mfg. Co., Providence, R. I.
Clough, R. M., Tolland, Conn.
Fellows Gear Shaper Co., Springfield, Vt.
Gleason Tool Co., Rochester, N. Y.
Gould & Eberhardt, Newark, N. J.
Harrington & Son Co., Edwin, Philadelphia, Pa.
Newton Mch. Tool Wks., Phil., Pa.
Niles Tool Works Co., New York.
Whiton Machine Co., D. E., New London, Conn.

Gears, Cut
Bilgram, Hugo, Philadelphia, Pa.
Boston Gear Wks., Boston, Mass.
Cleveland Gear Wks., Cleveland, O.
Fawcus Mach. Co., Pittsburgh, Pa.
Fellows Gear Shaper Co., Springfield, Vt.
Gleason Tool Co., Rochester, N. Y.
Gould & Eberhardt, Newark, N. J.
Grant Gear Works, Boston, Mass.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Horsburgh & Scott, Cleveland, O.
New Process Raw Hide Co., Syracuse, N. Y.
N. Y. Gear Works, Brooklyn, N. Y.
Nuttall Co., R. D., Pittsburgh, Pa.
Philadelphia Gear Works, Philadelphia, Pa.
Simonds Mfg. Co., Pittsburgh, Pa.
Van Dorn & Dutton Co., Cleveland, O.

Gears, Molded
Franklin Mfg. Co., Syracuse, N. Y.
Greenwald Co., I. & E., Cincin., O.
Poole & Son Co., Robt., Baltimore, Md.

Gears, Rawhide
Chicago Raw Hide Co., Chicago, Ill.
Fawcus Mch. Co., Pittsburgh, Pa.
New Process Raw Hide Co., Syracuse, N. Y.
Nuttall Co., R. D., Pittsburgh, Pa.

Gears, Worm
Albro-Clem Elevator Co., Philadelphia, Pa.
Fawcus Mach. Co., Pittsburgh, Pa.
Morse, Williams & Co., Phila., Pa.
Nuttall Co., R. D., Pittsburgh, Pa.
Simonds Mfg. Co., Pittsburgh, Pa.
Van Dorn & Dutton Co., Cleveland, O.

Graphite
Dixon Crucible Co., Jos., Jersey City, N. J.
Obermayer Co., S., Cincinnati, O.

Grinders, Center
Heald & Son, L. S., Barre, Mass.
Leland & Faulconer Mfg. Co., Detroit, Mich.

Grinders, Cock
Windsor Mach. Co., Windsor, Vt.

Grinders, Cutter
Adams Co., Dubuque, Iowa.
Automatic Mach. Co., Greenfield, Mass.
Cincinnati Milling Mach. Co., Cincinnati, O.
Garvin Mach. Co., New York.
Gould & Eberhardt, Newark, N. J.
Modern Tool Co., Erie, Pa.
Norton Emery Wheel Co., Worcester, Mass.
Oesterlein Mach. Co., Cincin., O.
Pratt & Whitney Co., Hartford, Conn.
Rivett Lathe Co., Boston, Mass.

Grinders, Disc
Besly & Co., Chas. H., Chicago, Ill.
Gorton Mach. Co., Geo., Racine, Wis.
Iroquois Mach. Co., Provi., R. I.
Ransom Mfg. Co., Oshkosh, Wis.

Grinders, Tool
Barnes Co., B. F., Rockford, Ill.
Barnes Co., W. F. & John, Rockford, Ill.
Diamond Mach. Co., Prov., R. I.
Gisholt Mach. Co., Madison, Wis.
Iroquois Mach. Co., Provi., R. I.
Landis Tool Co., Waynesboro, Pa.
Leland & Faulconer Mfg. Co., Detroit, Mich.
Northampton Emery Wheel Co., Leeds, Mass.
Oesterlein Mach. Co., Cincin., O.
Ransom Mfg. Co., Oshkosh, Wis.
Safety Emery Wheel Co., Springfield, O.
Whitney Mfg. Co., Hartford, Ct.

Grinders, Drill
Gorton Mach. Co., Geo., Racine, Wis.
Heald & Son, L. S., Barre, Mass.
Standard Tool Co., Cleveland, O.
Washburn Shops, Worcester, Mass.
Wilmarth & Morman Co., Grand Rapids, Mich.

Grinding Machines
Besly & Co., Chas. H., Chicago, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Builders' Iron Foundry, Providence, R. I.
Diamond Mach. Co., Prov., R. I.
Goodell-Pratt Co., Greenfield, Mass.
Gorton Mach. Co., Geo., Racine, Wis.
Hill, Clarke & Co., Boston, Mass.
Iroquois Mach. Co., Provi., R. I.
Landis Tool Co., Waynesboro, Pa.
Northampton Emery Wheel Co., Leeds, Mass.
Northern Elec. Mfg. Co., Madison, Wis.
Norton Emery Wheel Co., Worcester, Mass.
Ransom Mfg. Co., Oshkosh, Wis.
Safety Emery Wheel Co., Springfield, Mass.
Washburn Shops, Worcester, Mass.
Webster & Perks Tool Co., Springfield, O.
Wilmarth & Morman Co., Grand Rapids, Mich.

Grinding Wheels
Abrasive Material Co., Phila., Pa.
Builders' Iron Foundry, Providence, R. I.
Carborundum Co., Niagara Falls, N. Y.
Diamond Mach. Co., Provi., R. I.
Hampden Cor. Wheel Co., Brightwood, Mass.
Northampton Emery Wheel Co., Leeds, Mass.
Norton Emery Wheel Co., Worcester, Mass.
Safety Emery Wheel Co., Springfield, O.

Gun Barrel Machinery
Bement, Miles & Co., New York.
Diamond Mach. Co., Provi., R. I.
Niles Tool Works Co., New York.
Pond Mach. Tool Co., New York.
Reed Co., F. E., Worcester, Mass.

Hack Saw Blades and Frames
Goodell-Pratt Co., Greenfield, Mass.
Millers Falls Co., New York.
Starrett Co., L. S., Athol, Mass.
West Haven Mfg. Co., New Haven, Conn.

Hack Saws, Power
Hoefer Mfg. Co., Freeport, Ill.
Millers Falls Co., New York.

Hammers, Drop
Bement, Miles & Co., New York.
Billings & Spencer Co., Hartford, Conn.
Bliss Co., E. W., Brooklyn, N. Y.
Miner & Peck Mfg. Co., New Haven, Conn.
Toledo Mch. & Tool Co, Toledo, O.

Hammers, Pneumatic
Chicago Pneumatic Tool Co., Chicago, Ill.
Cleveland Pneumatic Tool Co., Cleveland, O.
Dallett & Co., Thos. H., Phila., Pa.
Phila. Pneu. Tool Co., Philadelphia, Pa.

Hammers, Steam
Bement, Miles & Co., New York.
Bethlehem Fdry. & Mach. Co., So. Bethlehem, Pa.
Chambersburg Engineering Co., Chambersburg, Pa.
Cleveland Punch & Shear Wks. Co., Cleveland, O.

Handles, Machine Tool
Schacht Mfg. Co., Cincinnati, O.

Heating Machines, Automatic
Am. Gas Furnace Co., New York.

Heating and Ventilating Apparatus
Buffalo Forge Co., Buffalo, N. Y.

Hoists, Electric
C & C Electric Co., New York.
Hunt Co., C. W., West New Brighton, N. Y.
Northern Engineering Works, Detroit, Mich.
Pawling & Harnischfeger, Milwaukee, Wis.

Hoists, Hand
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Moyer & Co., J. W., Philadel., Pa.
Yale & Towne Mfg. Co., New York.

Hoists, Pneumatic
Chicago Pneumatic Tool Co., Chicago, Ill.
Cleveland Pneumatic Tool Co., Cleveland, O.
Curtis & Co. Mfg. Co., St. Louis, Mo.
Northern Engineering Wks., Detroit, Mich.
Rand Drill Co., New York.

Hoisting and Conveying Machinery
Brown Hoisting Mchry. Co., New York.
Caldwell & Son Co., H. W., Chicago, Ill.
Hunt Co., C. W., West New Brighton, N. Y.
Link Belt Engineering Co., Philadelphia, Pa.
Moyer & Co., J. W., Philadel., Pa.
Niles-Bement-Pond Co., New York.

Indicators, Speed
Starrett Co., L. S., Athol, Mass.

Indicators, Steam
Crosby Steam Gage & Valve Co., Boston, Mass.

Inspection and Tests
Hunt Co., Robt. W., Chicago, Ill.

Injectors
Lunkenheimer Co., Cincinnati, O.
Sellers & Co., Wm., Phila., Pa.

Instruction Schools
See Schools, Correspondence.

Jacks, Hydraulic
Bethlehem Fdry. & Mch. Co., So. Bethlehem, Pa.
Watson-Stillman Co., New York.

Keys, Machine
Whitney Mfg. Co., Hartford, Ct.

Key Seaters
Baker Bros., Toledo, O.
Bement, Miles & Co., New York.
Chattanooga Mchy. Co., Chattanooga, Tenn.
Davis Mach. Co., W. P., Rochester, N. Y.
Mitts & Merrill, Saginaw, Mich.

Lamps, Arc
General Electric Co., N. Y. City.
Gen. Incan. Arc Light Co., N. Y. City.
Westinghouse Elec. & Mfg. Co., Pittsburgh, Pa.

Lathe Dogs
Armstrong Bros. Tool Co., Chicago, Ill.
Besly & Co., Chas. H., Chicago, Ill.
Le Count, Wm. G., So. Norwalk, Conn.
Pratt & Whitney Co., Hartford, Conn.

Lathes
American Tool Works Co., Cin., O.
Automatic Mach. Co., Greenfield, Mass.
Auto. Mach. Co., Bridgeport, Ct.
Barker & Chard Mach. T. Co., Cincinnati, O.
Barnes Co., B. F., Rockford, Ill.
Barnes Co., W. F., & John, Rockford, Ill.
Bement, Miles & Co., New York.
Blaisdell & Co., P., Worcester, Mass.
Bradford Mach. Tool Co., Cin., O.
Bullard Mach. Tool Co., Bridgeport, Conn.
Davis Mach. Co., W. P., Rochester, N. Y.
Diamond Machine Co., Provi., R. I.
Fairbanks Mch. Tool Co., Springfield, Ohio.
Fay & Scott, Dexter, Me.
Flather & Co., Nashua, N. H.
Garvin Mach. Co., New York.
Grant Tool Co., Franklin, Pa.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Hendey Mach. Co., Torrington, Ct.
Hill, Clarke & Co., Boston, Mass.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
McCabe, J. J., New York.
New Haven Mfg. Co., New Haven, Conn.
Niles Tool Works Co., New York.
Pond Mach. Tool Co., New York.
Pratt & Whitney Co., Hartford, Conn.
Reed Co., F. E., Worcester, Mass.

Lathes—*Continued*
Schumacher & Boye, Cincinnati, O.
Sebastian Lathe Co., Cincin., O.
Seneca Falls Mfg. Co., Seneca Falls, N. Y.
Washburn Shops, Worcester, Mass.

Lathes, Automatic Screw-Threading
Automatic Machine Co., Bridgeport, Conn.

Lathes, Bench
Faneuil Watch Tool Co., Boston, Mass.
Waltham Watch Tool Co., Springfield, Mass.

Letters, Pattern
Butler, A. G., N. Y. City.

Levels
Starrett Co., L. S., Athol, Mass.

Lockers, Clothes
Merritt & Co., Philadelphia, Pa.

Locomotives, Shop
Hunt Co., C. W., West New Brighton, N. Y.

Lubricants
Besly & Co., Chas. H., Chicago, Ill.
Dixon Crucible Co., Jos., Jersey City, N. J.

Lubricators
Besly & Co., Chas. H., Chicago, Ill.
Bowen Mfg. Co., Auburn, N. Y.
Crane Co., Chicago, Ill.
Lunkenheimer Co., Cincinnati, O.

Machinery Builders, Special
American Fdry. & Mach. Co., Hanover, Pa.
Blanchard Mach. Co., The, Boston, Mass.
Columbia Factory, Hartford, Ct.
Pratt & Whitney Co., Hartford, Conn.
Simonds Mfg. Co., Pittsburgh, Pa.
Stowell, J. A., Leominster, Mass.

Machine Screws
Worcester Mach. Screw Co., Worcester, Mass.

Machinists' Small Tools
Besly & Co., Chas. H., Chicago, Ill.
Billings & Spencer Co., Hartford, Conn.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Twist Drill Co., Cleveland, O.
Hammacher, Schlemmer & Co., New York.
Patterson, Gottfried & Hunter, Ltd., New York.
Sawyer Tool Mfg. Co., Fitchburg, Mass.
Slocomb & Co., J. T., Provi., R. I.
Starrett Co., L. S., Athol, Mass.

Measuring Machines
Rogers, John M., Boat, Gage & Drill Works, Gloucester City, N. J.

Mandrels, Expanding
Nicholson & Son, W. H., Wilkesbarre, Pa.

Mandrels, Solid
Cleveland Twist Drill Co., Cleveland, O.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Rogers, John M., Boat, Gage & Drill Works, Gloucester City, N. J.
Standard Tool Co., Cleveland, O.

Micrometer Calipers
Brown & Sharpe Mfg. Co., Providence, R. I.
Sawyer Tool Mfg. Co., Fitchburg, Mass.
Slocomb & Co., J. T., Providence, R. I.
Starrett Co., L. S., Athol, Mass.

Milling Attachments
The Adams Co., Dubuque, Iowa.
Cincinnati Milling Mach. Co., Cincinnati, O.
Kempsmith Mfg. Co., Milwaukee, Wis.
Oesterlein Mach. Co., Cincin., O.

Milling Machines, Bench
Faneuil Watch Tool Co., Boston, Mass.
Waltham Watch Tool Co., Springfield, Mass.

Milling Machines, Portable
Underwood & Co., H. B., Philadelphia, Pa.

Milling Machines, Horizontal
Adams Co., Dubuque, Iowa.
Beaman & Smith Co., Provi., R. I.
Bement, Miles & Co., New York.
Franklin Mach. Wks., Phila., Pa.
Grant Tool Wks., Franklin, Pa.
Hendey Mach. Co., Torrington, Ct.
Ingersoll Mill. Mach. Co., Rockford, Ill.
Newton Mach. Tool Wks., Philadelphia, Pa.
Niles Tool Works Co., New York.
Pratt & Whitney Co., Hartford, Conn.

Milling Machines, Plain
American Tool Wks. Co., Cin., O.
Aurora Tool Works, Aurora, Ind.
Bement, Miles & Co., New York.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mach. Co., Cincinnati, O.
Garvin Mach. Co., New York.
Hendey Mach. Co., Torrington, Ct.
Hill, Clarke & Co., Boston, Mass.
Kempsmith Mfg. Co., Milwaukee, Wis.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
Oesterlein Mach. Co., Cincin., O.
Whitney Mfg. Co., Hartford, Ct.

Milling Machines, Universal
American Tool Wks. Co., Cin., O.
Aurora Tool Works, Aurora, Ind.
Bement, Miles & Co., New York.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mach. Co., Cincinnati, O.
Garvin Mach. Co., New York.
Hendey Mach. Co., Torrington, Ct.
Hill, Clarke & Co., Boston, Mass.
Kempsmith Mfg. Co., Milwaukee, Wis.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
Niles Tool Works Co., New York.
Oesterlein Mach. Co., Cincin., O.
Waltham Watch Tool Co., Springfield, Mass.

Milling Machines, Vertical
Bement, Miles & Co., New York.
Brown & Sharpe Mfg. Co., Providence, R. I.
Garvin Mach. Co., New York.
Ingersoll Mill. Mach. Co., Rockford, Ill.
Newton Mach. Tool Wks., Philadelphia, Pa.
Niles Tool Works Co., New York.
Pratt & Whitney Co., Hartford, Conn.

Milling Tools, Adjustable
Geometric Drill Co., Westville, Ct.
Rogers, Boat, Gage & Drill Wks., John M., Gloucester City, N. J.

Molding Machines
The Adams Co., Dubuque, Iowa.
Tabor Mfg. Co., Philadelphia, Pa.
Webster & Perks Tool Co., Springfield, O.

Mortising Machines, Chain
New Britain Mch. Co., New Britain, Conn.

Motors, Electric
Akron Elec. Mfg. Co., Akron, O.
C & C Electric Co., New York.
Commercial Electric Co., Indianapolis, Ind.
Crocker-Wheeler Co., Ampere, N. J.
Eck Dynamo & Motor Works, Belleville, N. J.
General Electric Co., New York.
General Incan. Arc Light Co., New York.
Jantz & Leist Elec. Co., Cin., O.
Northern Elec. Mfg. Co., Madison, Wis.
Robbins & Myers Co., Springfield, Ohio.
Sprague Electric Co., New York.
Triumph Elec. Co., Cincinnati, O.
Westinghouse Elec. & Mfg. Co., Pittsburgh, Pa.

Name Plates
Franklin Mfg. Co., Syracuse, N. Y.

Nut Tappers
See Bolt and Nut Machinery.

Oil Cups and Covers
Bay State Stamping Co., Worcester, Mass.
Besly & Co., Chas. H., Chicago, Ill.
Bowen Mfg. Co., Auburn, N. Y.
Crane Co., Chicago, Ill.
Lunkenheimer Co., Cincinnati, O.
The Winkley Co., Hartford, Conn.

Oils
Besly & Co., Chas. H., Chicago, Ill.
Houghton & Co., E. F., Philadelphia, Pa.

Packing, Steam Joint
Jenkins Bros., New York.

Pans, Lathe
New Britain Mch. Co., New Britain, Conn.

Patents
Baldwin, Davidson & Wight, Washington, D. C.
Cromwell, W. H., Washington, D. C.
Cullen, Orlan Clyde, Washington, D. C.
Patent Title & Guarantee Co., New York.

Pattern Shop Machinery
American Machinery Co., Grand Rapids, Mich.
Baker Bros., Toledo, O.
Fay & Scott, Dexter, Me.

Patterns, Wood
Balkwill Pattern Works, Cleveland, Ohio.
Gobeille Pattern Co., Cleveland, O.
Lorentz & Evarts, Hartford, Conn.

Phosphor Bronze
Phosphor Bronze Smelting Co., Philadelphia, Pa.

Pipe and Fittings
Crane Co., Chicago, Ill.

Pipe Cutting and Threading Machines
Curtis & Curtis Co., Bridgeport, Conn.
Merrell Mfg. Co., Toledo, O.
Saunders' Sons, D., Yonkers, N. Y.
Wells Bros. Co., Greenfield, Mass.

Pipe Fitters' Tools
Cleveland Twist Drill Co., Cleveland, O.
Saunders' Sons, D., Yonkers, N. Y.
Standard Tool Co., Cleveland, O.

Planer, Jack
Armstrong Bros. Tool Co., Chicago, Ill.

Planers
Amer. Tool Wks. Co., Cincin., O.
Bartlett, E. E., Boston, Mass.
Belmer-Eames Tool Co., Cin., O.
Bement, Miles & Co., New York.
Betts Mach. Co., Wilmington, Del.
Cincinnati Planer Co., Cincin., O.
Detrick & Harvey Mch. Co., Baltimore, Md.
Flather Planer Co., Mark, Nashua, N. H.
Garvin Mach. Co., New York.
Gray Co., G. A., Cincinnati, O.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Hendey Mach. Co., Torrington, Ct.
Hill, Clarke & Co., Boston, Mass.
Niles Tool Works Co., New York.
New Haven Mfg. Co., New Haven, Conn.
Pond Mach. Tool Co., New York.
Sellers & Co., Wm., Phila., Pa.
Whitcomb Mfg. Co., Worcester, Mass.
Woodward & Powell Planer Co., Worcester, Mass.

Planers, Portable
Underwood & Co., H. B., Philadelphia, Pa.

Planers, Rotary
Bement, Miles & Co., New York.
Cleveland Punch & Shear Works, Cleveland, O.
Franklin Mach. Wks., Phila., Pa.
Newton Mch. Tool Works, Philadelphia, Pa.
Pond Mach. Tool Co., New York.
Underwood & Co., H. B., Phila., Pa.

Presses, Hand
Elmes Eng. Co., Chas. F., Chicago, Ill.

Presses, Power
Automatic Mach. Co., Bridgeport, Conn.
Bethlehem Fdry. & Mch. Co., So. Bethlehem, Pa.
Bliss Co., E. W., Brooklyn, N. Y.
Dill Mach. Works, T. C., Philadelphia, Pa.
Mossberg & Granville Mfg. Co., Providence, R. I.
Toledo Mch. & Tool Co., Toledo, O.

Presses, Hydraulic
Bement, Miles & Co., New York.
Elmes Eng Co., Chas. F., Chicago, Ill.
Watson-Stillman Co., New York.

Profilers
Garvin Mach. Co., New York.
Pratt & Whitney Co., Hartford, Conn.

Pulley Turning and Boring Machines
Harrington, Son & Co., Edwin, Philadelphia, Pa.
New Haven Mfg. Co., New Haven, Conn.
Niles Tool Works Co., New York.

Pulleys
Cresson Co., Geo. V., Philadel., Pa.
Jones Fdry. & Mch. Co., W. A., Chicago, Ill.
Poole & Son Co., Robt., Baltimore, Md.
Reeves Pulley Co., Columbus, Ind.

Pulleys, Friction Cone
Evans Friction Cone Co., Boston, Mass.

Pumps, Hydraulic
Elmes Eng. Co., Chas. F., Chicago, Ill.
Watson-Stillman Co., New York.

Punches, Hydraulic
Bement, Miles & Co., New York.
Bethlehem Fdry. & Mch. Co., So. Bethlehem, Pa.
Watson-Stillman Co., New York.

Punches, Power
Bliss Co., E. W., Brooklyn, N. Y.
Bremer Mach. & Tool Co., Kalamazoo, Mich.
Buffalo Forge Co., Buffalo, N. Y.
Cleveland Punch & Shear Wks., Cleveland, O.
Hilles & Jones Co., Wilmington, Del.
Long & Allstatter Co., Hamilton, Ohio.
Reade Mchry Co., Cleveland, O.

Rack Cutting Machines
Fellows Gear Shaper Co., Springfield, Vt.
Gould & Eberhardt, Newark, N. J.
Le Belond Mach. Tool Co., R. K., Cincinnati, O.
Reed Co., F. E., Worcester, Mass.

Racks, Cut
Fellows Gear Shaper Co., Springfield, Vt.
Nuttall Co., R. D., Pittsburgh, Pa.
Simonds Mfg. Co., Pittsburgh, Pa.
Van Dorn & Dutton Co., Cleve., O.

Racks, Tool
New Britain Mach. Co., New Britain, Conn.

Reamers
Cleveland Twist Drill Co., Cleveland, O.
Clough, R. M., Tolland, Conn.
McCrosky & Huber, Cincinnati, O.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt & Whitney Co., Hartford, Conn.
Rogers, John M., Boat, Gage & Drill Works, Gloucester City, N. J.
Standard Tool Co., Cleveland, O.
Wells Bros. Co., Greenfield, Mass.

Reaming Stands
Flather Planer Co., Mark, Nashua, N. H.

Rheostats
General Incan. Arc Light Co., New York.

Riveters, Hydraulic
Bement, Miles & Co., New York.
Watson-Stillman Co., New York.

Riveters, Pneumatic
Bement, Miles & Co., New York.
Cleveland Pneumatic Tool Co., Cleveland, O.
Philadelphia Pneumatic Tool Co., Philadelphia, Pa.

Riveting Machines
Bement, Miles & Co., New York.
Bethlehem Foundry & Mach. Co., So. Bethlehem, Pa.
Chambersburg Engineering Co., Chambersburg, Pa.
Long & Allstatter Co., Hamilton, Ohio.

Roller and Ball Bearings
Ball Bearing Co., Philadel., Pa.
Mossberg & Granville Mfg. Co., Providence, R. I.
Roller Bearing & Equipment Co., Keene, N. H.

Rolling Mill Machinery
Cleveland Punch & Shear Wks. Co., Cleveland, O.
Diamond Drill & Mch. Co., Birdsboro, Pa.
Dill Mach. Works, T. C., Philadelphia, Pa.
Hilles & Jones Co., Wilmington, Del.
Mossberg & Granville Mfg. Co., Providence, R. I.
Pratt & Whitney Co., Hartford, Conn.

Safety Valves, Pop
Crane Co., Chicago, Ill.
Crosby Steam Gage & Valve Co., Boston, Mass.
Lunkenheimer Co., Cincinnati, O.

Sawing Machines, Metal
Cleveland Punch & Shear Works Co., Cleveland, O.
Newton Mach. Tool Works, Philadelphia, Pa.
Pratt & Whitney Co., Hartford, Conn.
Reade Mchry. Co., Cleveland, O.

Schools, Correspondence
Amer. School of Correspondence, Boston, Mass.
Consolidated Schools, N. Y. City.
International Correspond. Schools, Scranton, Pa.

Schools, Technical
Mich. College of Mines, Houghton, Mich.

Screw Machines, Automatic
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Machine Screw Co., Cleveland, Ohio.
Dreses Mach. Tool Co., Cincin., O.
Windsor Mach. Co., Windsor, Vt.

Screw Machines, Hand
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Mch. Screw Co., Cleveland, O.
Garvin Mach. Co., New York.
Jones & Lamson Mch. Co., Springfield, Vt.
Pearson Mach. Co., Chicago, Ill.
Potter & Johnston Mach. Co., Pawtucket, R. I.
Pratt & Whitney Co., Hartford, Conn.
Warner & Swasey Co., Cleveland, Ohio.
Windsor Mach. Co., Windsor, Vt.

Screw Machinery, Wood and Lag
Baker Bros., Toledo, Ohio.
Cook Co., Asa S., Hartford, Conn.

Screw Plates
Besly & Co., Chas. H., Chicago, Ill.
Carpenter Tap & Die Co., J. M., Pawtucket, R. I.
Card Mfg. Co., S. W., Mansfield, Mass.
Hart Mfg. Co., Cleveland, O.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Wells Bros. Co., Greenfield, Mass.
Wiley & Russell Mfg. Co., Greenfield, Mass.

Second Hand Machinery
Baird Machy. Co., U., Pittsburgh, Pa.
Bowler & Co., Geo. H., Cleveland, Ohio.
Carlin Mchry. & Supply Co., Allegeny, Pa.
Dawson, John H., Chicago, Ill.
Fairbanks Co., Philadelphia, Pa.
Garvin Mch. Co., New York.
Hall's Sons, Sam'l, New York.
Hill, Clarke & Co., Boston, Mass.
Marshall & Huschart Mchry. Co., Chicago, Ill.
McCabe, J. J., New York.
Niles Tool Works Co., New York.
Osborn Mchry. Co., New Haven, Conn.
Pratt & Whitney Co., Hartford, Conn.
Prentiss Tool & Supply Co., New York.
Toomey, Frank, Philadelphia, Pa.
Wormer Machy. Co., C. C., Detroit, Mich.

Separators, Magnetic
Sawyer, Ezra, Worcester, Mass.

Shafts, Flexible
Chicago Flexible Shaft Co., Chicago, Ill.

Shapers
Amer. Tool Wks. Co., Cincin., O.
Bement, Miles & Co., New York.
Cincinnati Shaper Co., Cincin., O.
Flather Planer Co., Mark, Nashua, N. H.
Garvin Mach. Co., New York.
Hendey Mach. Co., Torrington, Ct.
Gould & Eberhardt, Newark, N. J.
Hill, Clarke & Co., Boston, Mass.
Kelly Co., R. A., Xenia, Ohio.
New Haven Mfg. Co., New Haven, Conn.
Niles Tool Works Co., New York.
Potter & Johnston Mach. Co., Pawtucket, R. I.
Smith & Mills, Cincinnati, O.
Steptoe & Co., John, Cincinnati, O.

Shears, Power
Bethlehem Fdry. & Mch. Co., So. Bethlehem, Pa.
Bliss Co., E. W., Brooklyn, N. Y.
Bremer Mach. & Tool Co., Kalamazoo, Mich.
Buffalo Forge Co., Buffalo, N. Y.
Cleveland Punch & Shear Works, Cleveland, O.
Hilles & Jones Co., Wilmington, Del.
Long & Allstatter Co., Hamilton, Ohio.
Reade Mchry. Co., Cleveland, O.
Toledo Mch. & Tool Co., Toledo, O.

Shears, Rotary
Bethlehem Foundry & Mach. Co., So. Bethlehem, Pa.
Detrick & Harvey Mach. Co., Baltimore, Md.

Shelving, Shop
New Britain Mach. Co., New Britain, Conn.

Slide Rests
Bartlett Co., E. E., Boston, Mass.
Reed Co., F. E., Worcester, Mass.

Slotters
Baker Bros., Toledo, Ohio.
Bement, Miles & Co., New York
Betts Mach. Wks., Phila., Pa.
Dill Mach. Wks., T. C., Phila., Pa.
Franklin Mach. Wks., Phila., Pa.
Garvin Mach. Co., New York.
New Haven Mfg. Co., New Haven, Conn.
Newton Mach. Tool Wks., Philadelphia, Pa.
Niles Tool Works Co., New York.

Speed Limit System
Consolidated Engine Stop Co., New York.

Springs
Cleveland Wire Spring Co., Cleveland, O.

Sprocket Chains
See Driving Chains.

Stamps, Letters and Figures
Schwerdtle Stamp Co., Bridgeport, Conn.

Stampings, Sheet Steel
Automobile & Cycle Parts Co., Cleveland, O.

Steel, Machinery
International Steel & Mchry. Co., New York.
Patriarche & Bell, New York.
Ward & Son, Edgar T., Boston, Mass.

Steel, Sheet
Automobile & Cycle Parts Co., Cleveland, O.
Ward & Son, Edgar T., Boston, Mass.

Steel, Tool
International Steel & Mach. Co., New York.
Patriarche & Bell, New York.

Straightener, Hydraulic
Bement, Miles & Co., New York.
Watson-Stillman Co., New York.

Swaging Machines
Excelsior Needle Co., Torrington, Conn.

Switchboards
C & C Electric Co., New York.
Triumph Elec. Co., Cincinnati, O.

Taps, Collapsing
Geometric Drill Co., Westville, Ct.

Tapping Machines and Attachments
Baker Bros., Toledo, O.
The Beaman & Smith Co., Providence, R. I.
Bickford Drill & Tool Co., Cin., O.
Cincinnati Mach. Tool Co., Cincinnati, O.
Errington, F. A., N. Y. City.
Fosdick & Holloway Mach. Tool Co., Cincinnati, O.
Garvin Mach. Co., New York.
Geometric Drill Co., New York.
Geometric Drill Co., Westville, Ct.
Gould & Eberhardt, Newark, N. J.
Pratt & Whitney Co., Hartford, Conn.
Seneca Falls Mfg. Co., Seneca Falls, N. Y.
Webster & Perks Tool Co., Springfield, O.

Taps and Dies
Besly & Co., Chas. H., Chicago, Ill.
Card Mfg. Co., S. W., Mansfield, Mass.
Carpenter Tap & Die Co., J. M., Pawtucket, R. I.
Cleveland Twist Drill Co., Cleveland, O.
Crane Co., Chicago, Ill.
Hammacher, Schlemmer & Co., New York.
Hart Mfg. Co., Cleveland, O.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt & Whitney Co., Hartford, Conn.
Standard Tool Co., Cleveland, O.
Wells Bros. Co., Greenfield, Mass.
Wiley & Russell Mfg. Co., Greenfield, Mass.

Telephone System
Clarke Auto. Telephone Switch Board Co., Providence, R. I.

Threading Dies, Opening
Errington, F. A., New York.
Geometric Drill Co., Westville, Ct.
Jones & Lamson Mch. Co., Springfield, Vt.
Modern Tool Co., Erie, Pa.
Pratt & Whitney Co., Hartford, Conn.

Thread Cutting Tools
Besly & Co., Chas. H., Chicago, Ill.
Hart Mfg. Co., The, Cleveland, O.
Pratt & Whitney Co., Hartford, Conn.
Rivett-Dock Co., Boston, Mass.

Tool Holders
Armstrong Bros. Tool Co., Chicago, Ill.
McCrosky & Huber, Cincinnati, O.

Tools
See Machinists' Small Tools.

Transmission Machinery
Allston Fdry. Co., Boston, Mass.
Caldwell & Son Co., H. W., Chicago, Ill.
Cresson & Co., Geo. V., Phila., Pa.
Jones Fdry. & Mch. Co., W. A., Chicago, Ill.
Link-Belt Engineering Co., Philadelphia, Pa.
Patterson, Gottfried & Hunter, Ltd., New York.
Reeves Pulley Co., Columbus, Ind.

Traps, Steam
Houghton & Co., E. F., Philadelphia, Pa.

Trolleys and Tramways
Brown Hoisting Machy. Co., N. Y. City.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Hunt Co., C. W., West New Brighton, N. Y.
Link Belt Engineering Co., Philadelphia, Pa.
Maris Bros., Philadelphia, Pa.
Moyer & Co., J. W., Philadel., Pa.
Yale & Towne Mfg. Co., New York.

Trimmers, Wood
Amer. Mchry. Co., Grand Rapids, Mich.
Leland & Faulconer Mfg. Co., Detroit, Mich.
Washburn Shops, Worcester, Mass.

Turrets, Carriage
Fay & Scott, Detxer, Me.

Turret Machines
Automatic Mach. Co., Greenfield, Mass.
Barker & Chard M. T. Co., Cin., O.
Bradford Mach. Tool Co., Cincinnati, O.
Brown & Sharpe Mfg. Co., Providence, R. I.
Bullard Mach. Tool Co., Bridgeport, Conn.
Cleveland Mach. Screw Co., Cleveland, O.
Dreses Mach. Tool Co., Cincin., O.
Flather & Co., Nashua, N. H.
Garvin Mach. Co., New York.
Gisholt Mch. Co., Madison, Wis.
Grant Tool Co., Franklin, Pa.
Hill, Clarke & Co., Boston, Mass.
Jones & Lamson Mch. Co., Springfield, Vt.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
Lodge & Shipley Mach. Tool Co., Cincinnati, O.
Niles Tool Works Co., New York.
Pearson Mach. Co., Chicago, Ill.
Potter & Johnston Mach. Co., Pawtucket, R. I.
Warner & Swasey Co., Cleveland, Ohio.
Windsor Mach. Co., Windsor, Vt.

Twist Drills
Cleveland Twist Drill Co., Cleveland, O.
Etna Mfg. Co., New York.
Hammacher, Schlemmer & Co., New York.
Morse Twist Drill & M. Co., New Bedford, Mass.
Standard Tool Co., Cleveland, O.

Unions, Brass
Nolte Brass Co., Springfield, O.

Universal Joints
Baush Machine Tool Co., Springfield, Mass.

Valves
See Steam Fittings.

Vises, Drill
Hollands Mfg. Co., Erie, Pa.

Vises, Metal Workers'
Hammacher Schlemmer & Co., New York.
Parker Co., Chas., Meriden, Conn.
Prentiss Vise Co., New York.
Walworth Mfg. Co., Boston, Mass.

Vises, Pipe
Curtis & Curtis Co., Bridgeport, Conn.
Prentiss Vise Co., New York.
Saunders' Sons, D., Yonkers, N. Y.
Walworth Mfg. Co., Boston, Mass.

Vises, Planer and Shaper
Cincinnati Planer Co., Cincin., O.
Hendey Mach. Co., Torrington, Ct.
Pratt & Whitney Co., Hartford, Conn.

Vises, Wood Workers'
Hammacher, Schlemmer & Co., New York.
Wyman & Gordon, Worcester, Mass.

Welding Machines
Long & Allstatter Co., Hamilton, Ohio.

Wire-Forming Machinery
Automatic Mach. Co., Bridgeport, Conn.
Mossberg & Granville Mfg. Co., Providence, R. I.

Worm Hobbing Machines
Grant Tool Wks., Franklin, Pa.
Pratt & Whitney Co., Hartford, Conn.

Worm Milling Machines
Cleveland Mach. Screw Co., Cleveland, O.
Pratt & Whitney Co., Hartford, Conn.

Wrenches
Coes Wrench Co., Worcester, Mass.

Wrenches, Drop Forged
Billings & Spencer Co., Hartford, Conn.
Williams & Co., J. H., Brooklyn, N. Y.

The Universal Drafting Machine.

The young man who invented the "drafting machine" which we illustrate herewith was, up to a short time ago, doing drafting and engineering work for the Wellman-Seaver-Morgan Engineering Company, of Cleveland, Ohio. As he related the origin of the machine to the writer, it was about as follows: A hurry-up job of scaled plotting had to be done one day, and at its completion the doer of it reflected that most of his time and energy had been expended in reaching for the T-square-head, for the triangle and for the scale; alternately picking these up and laying them down again. This led to some thinking about better mechanical means and to the final result of the perfected machine as we here show it, and which has had, first, the hearty approval of Mr. Wellman, and, since then, that of a number of prominent engineers and draftsmen.

As will be seen by reference to Fig. 1, it is very simple; it is secured to the upper left-hand corner of the board, where two arms of equal length are pivoted. The other ends of these arms are pivoted to a ring and to this ring are pivoted two other arms, the two arms of each pair being parallel. The extremities of the last mentioned pair of arms are pivoted to a head upon which is a circular plate with graduations, and just 90 degrees apart on this head are sockets for the reception of graduated rules or straight-edges. The result is a pair of ruling edges always at right angles to each other, which may be moved to any point upon the board, practically without resistance, and which, when brought to any part of the board, are precisely parallel with their position at any

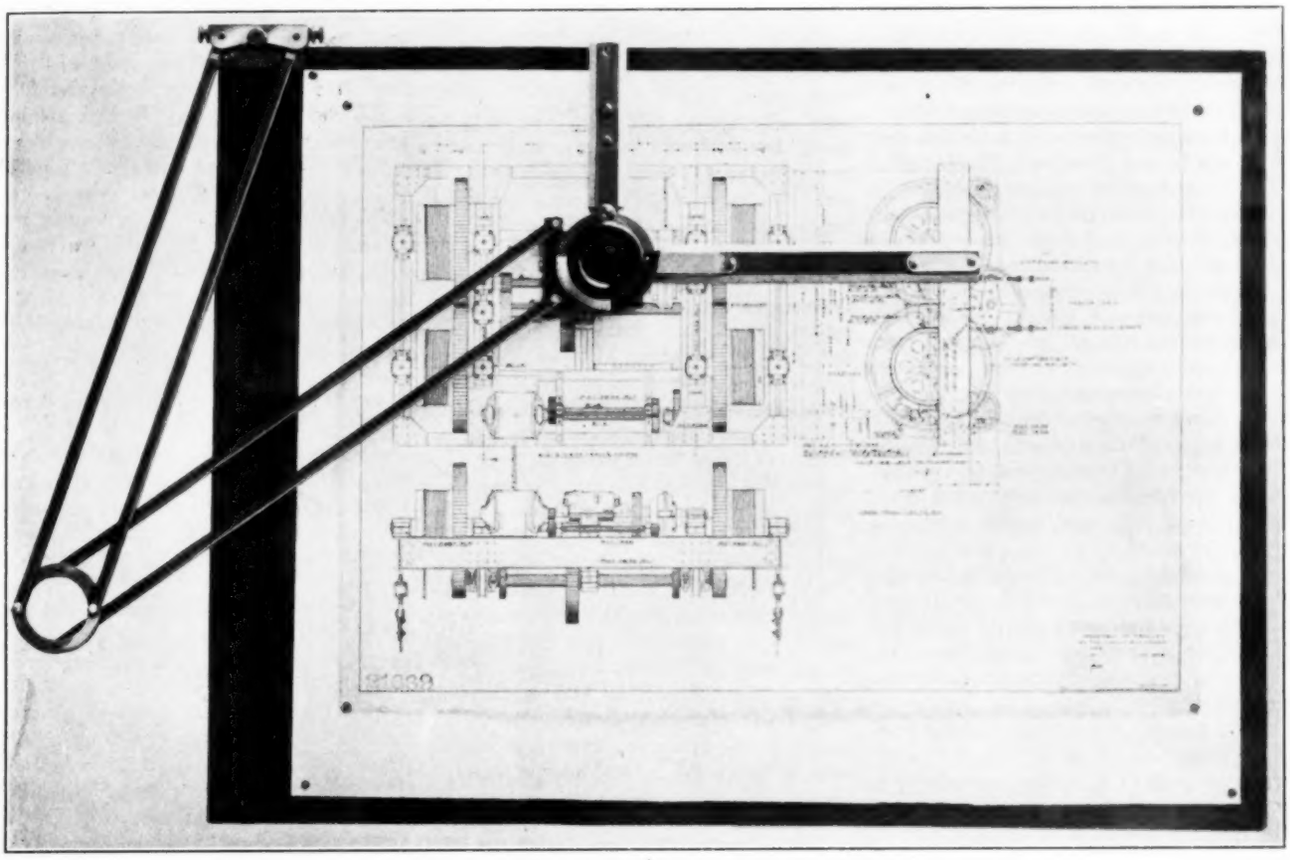


FIG. 1. THE UNIVERSAL DRAFTING MACHINE.

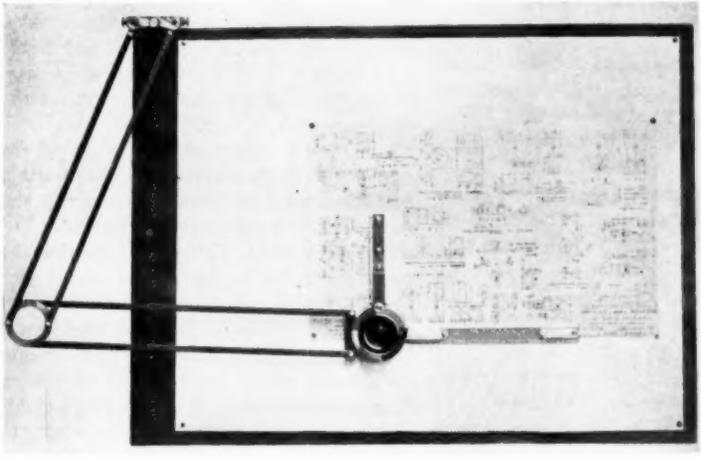


FIG. 2.

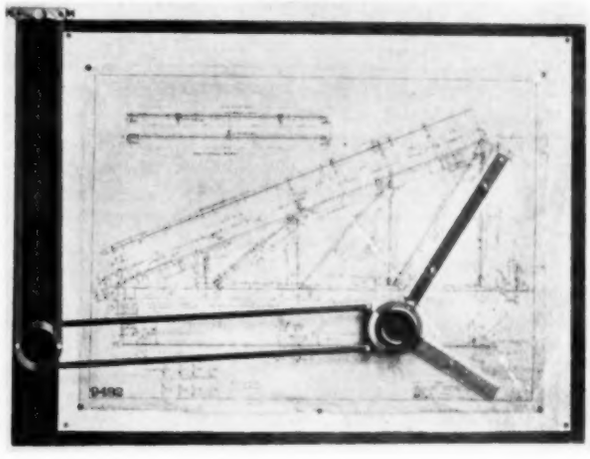


FIG. 3.

EXAMPLES OF THE USE OF THE UNIVERSIAL DRAFTING MACHINE.

former position upon it; so that horizontal and vertical lines may be drawn to *definite lengths* at once upon any part of the drawing with absolutely no tools or appliances to be handled, except to move the scale to the desired position and use the pencil.

To quote the words of the inventor—words which an examination of the machine leads us to endorse: "If the draftsman had a scale with a ruling edge and possessed the ability to place this scale accurately in any desired position without effort, he would never lay it aside and use the T-square and triangles. The Universal Drafting Machine supplies this ability."

It is of course obvious that angular work is as easy as that which consists of horizontal and vertical lines, it being necessary only to set the protractor to the required angle; and for such commonly used angles as 15° 40′, 30°, 45° and 60°, spring stops are provided which enable the square to be instantly set to these angles without reference to the graduations. Blades are readily exchanged, and though it is not expected that the bearings, which are of phosphor-bronze, will wear perceptibly for a long time, a conical adjustment is provided.

Measured lines at right angles to each other constitute the bulk of the draftsman's work; on such work it is obvious that the machine will save much time, and its use is correspondingly advantageous on angular work.

If the simple operation of drawing two such lines is to be performed, a careful comparison of each separate and distinct or elementary operation involved in doing it by the T-square or parallel ruler method with the very few such operations required when using this machine gives some very striking results.

The machine is used in many cases in place of cross-section paper. It gives all the advantages of this paper with none of its disadvantages, furnishes a ruling edge by means of which a line may be drawn more rapidly than freehand, and takes care of all angular work. The finished drawing has a decidedly neater appearance.

Both edges of the blades are graduated, and blades having any desired scales are supplied, also a long ruler for inking.

The machine is made by the Universal Drafting Machine Company, Blackstone Building, Cleveland, Ohio.

From the Note Book of a Cosmopolitan.

EVOLUTION OF MACHINE TOOLS.

Evolution in machine tools. Why not? As a subject of interest and study, I don't see why it should not rank with other scientific questions. Read the life history of Darwin, Gray, Agassiz, Lyell, and note the pervading enthusiasm in every discovery of what is old and gone before. It is apparently by the close study of what has preceded our present knowledge that the future is to be revealed. I am not quite confident that the same relative value can be claimed for a study of the first or early machine tools. But there can be no question as to the extreme interest to every one who is engaged in mechanical pursuits as to where and how our well-known types have developed to their present state of p rfection or imperfection, as the case may be.

. . . . . .

The complete history of all of our machine tools, with the exception of the lathe, will not take us back more than a hundred years. And how easy and simple is the history of our workshops compared with the searchings of savants for geological and paleontological discoveries—searching mountains for glacier-scratched surfaces to confirm theories of an ice age; excavating fossil deposits and building up extinct forms from even a single bone. But with our machine tools and presses, how recent compared with other forms of researches. We have all the work ready done, but how few really know the beginnings of our standard types of machine tools. And will you allow me to say, Mr. Editor, in the very smallest type in your printing office, that our countrymen are perhaps the most ignorant of all? Perhaps this is natural, as we all are content to agree that our successful machinists have not led that method of life which permits of searching after things in the past. "To-morrow" or "to-day" is the watchword with them. But when men earn hours of leisure as one of the results of hard work, their thoughts will turn to ancient history, even if only of a wheelbarrow.

. . . . . .

Fancy picking up a piece of scrap casting in the foundry yard and recognizing it as a part of an old Whitworth shaper of the early "forties." But I can imagine this. I can remember, when a youngster, when I was immensely interested in types of machine tools, and fortunately was able to visit many shops in the East and West, I could at once "spot" a machine across the shop without having to look for a name plate. There were not so many "types" as to-day, of course, and each for some reason I have never fathomed, had a personality in the design as distinct as the proverbial long, lean Yankee and the big Buckeyes and Hoosiers of the West. Each machine was of a different architecture, apparently. Mr. Bement's early designs were of the ribbed order, and certain of the curves in his frames could never be mistaken. This great designer kept on with plates and ribs long after his neighbors, the Sellers, had adopted cored sections wherever possible. Perhaps Messrs. Sellers' earlier connection and acquaintance with English practice will explain this. The Niles machines I could not always spot, as they looked at first like Bement's, but a nearer glance always showed some deviation in a detail here or there that stamped the origin. Again, the New England machines were built up of members, bolted together, each in their own particular and distinct way, by all the well-known makers. A Putnam machine was not to be confused with a New Haven one. Nor could the Pratt & Whitney hide its parentage even in the dark. I used almost to worship at the shrine of these first designers at a time when I knew nothing of the causes. For example, I did not realize the want of large tools in New England to treat machine frames cast in one piece. No large planing machines, no floor plate boring machines, and a lack of foundry skill that precluded the risk of putting all their eggs in one basket by attempting to cast frames and brackets together. Besides there were not the handling facilities. Cranes were not luxuries then because they were an unknown quantity. Philadelphia shops were undoubtedly the first in pioneering in unbeaten tracks in machine-tool practice. They put down large machines, and developed foundry practice in cored work, and in casting large pieces. It is now generally recognized that the Philadelphia school, as I prefer to call it, became the parent of the so-called American types of machine tools of to-day.

Automatic Cutter Grinder.

The half-tones show a machine for grinding automatically straight or spiral reamers and cutters. Fig. 1 shows the machine arranged for grinding a spiral cutter, and Fig. 2 shows it fitted with a plain head for grinding a hand reamer. The manner in which the machine is driven is clearly shown and needs little explanation. Cone pulley *A*—belted from the small cone on the driving shaft at the base of the machine—drives a shaft carrying a worm which meshes with worm wheel *C*. This worm wheel, which has a slotted face, forms a crank disk and drives connecting rod *H*, which in turn operates a rack meshing with pinion *J*. At the top of this pinion is a worm gear engaging a screw rack *D* mounted lengthwise of the table or carriage, and as pinion and worm gear are turned by the connecting rod and rack the table travels along the bed. The stroke or travel is varied by adjusting the crank-pin block in the slot in worm gear *C*. The table can be moved by hand by putting a wrench on the shank of screw D. It can be adjusted vertically by means of a hand wheel *E*, and can be swung around to any angle desired. As the table nears the end of its travel to the left the reamer or cutter being ground is automatically indexed. Resting against a tooth of the reamer in Fig. 2 is seen a finger or pawl. This pawl is carried in a holder which is free to move in and out on a stud in a bracket bolted to the front of the table. The holder is shown at *B*, Fig. 1; the attachment being moved to the right in this view in order to show the spiral cutter. At the bottom of the holder is a roller *G*, which, as the table moves

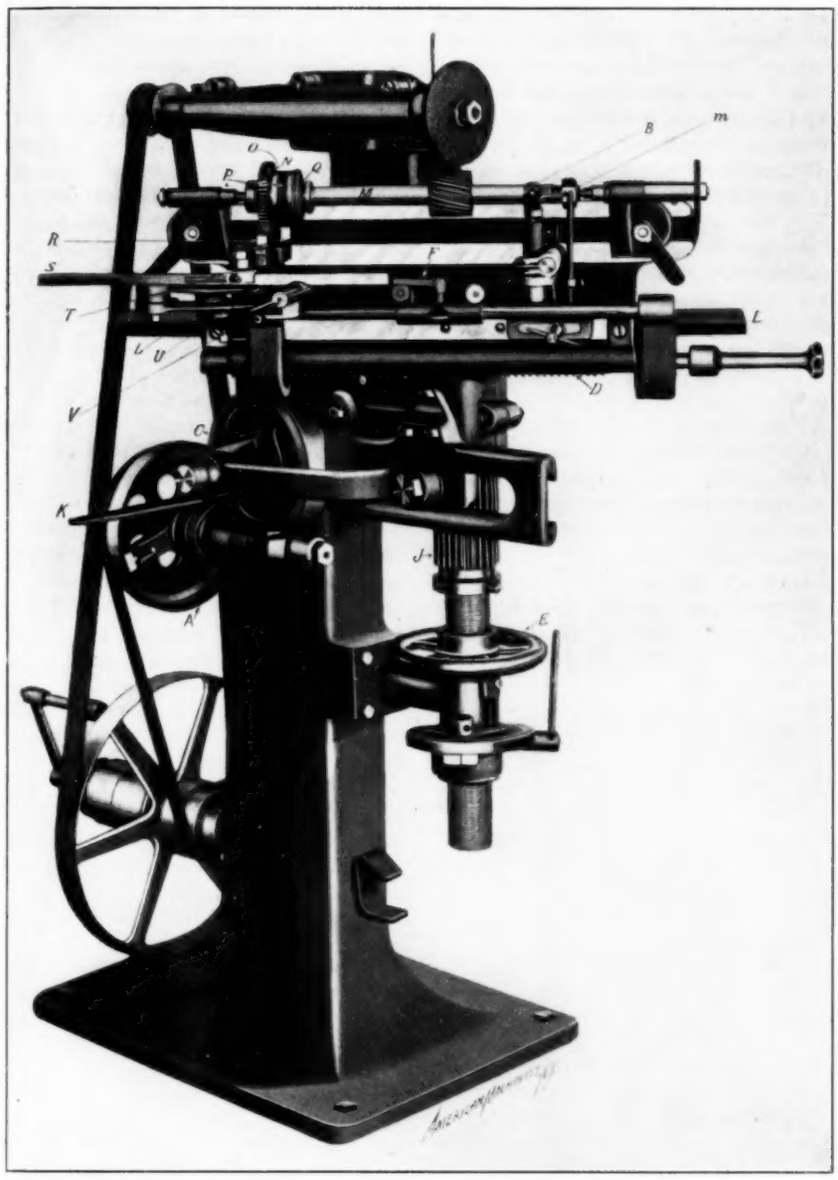


FIG. 1. AUTOMATIC CUTTER GRINDER.

along, strikes the dog *F* and forces the holder and pawl forward, thus turning the cutter or reamer one tooth, this operation being repeated each time the work moves to the left.

Thus each tooth passes twice under the wheel before the pawl brings another tooth into position. The bracket that carries the pawl holder, and the sleeve on which is mounted the dog *F*, can of course be adjusted to any desired position to suit the length of the cutter or reamer being ground. When grinding a spiral cutter the plain head is removed and a special head shown in Fig. 1 is put on in its place. The cutter is mounted on a mandrel *M*, the left-hand end of which is held in a sleeve *N*, carried by the head. The gear segment shown on this sleeve is fitted between a shoulder in the sleeve and a feathered disk *O*. Between this disk and flange *Q* is a rubber ring *P*, which forms a friction disk, and as the gear is rotated, the sleeve and arbor turn with it. The gear is turned by the rack *R*, which is connected to the bar *S* by the sliding block *T*. The bar S is fastened to an arm *U* having worm teeth meshing with a worm on shaft *V*. The bar can thus be adjusted to any angle necessary for giving the proper amount of rotation to the cutter mandrel. Spiral cutters are indexed in the same manner as straight tooth cutters. The pawl is placed against the cutter tooth and as it is forced forward by the roller *G* striking dog *F*, the friction of the rubber disk in the head is overcome and the cutter turned the proper distance. For different lengths of cutters three speeds are provided, these speeds being controlled by lever *K*. The machine will take in work 6 inches in diameter, 16 inches long, and will grind 6 inches in diameter, 10½ inches long. Provision is made for properly oiling all bearings, and all working surfaces are well protected from dust. This grinder is made by F. Gleason Machine Works, Olney, Philadelphia.

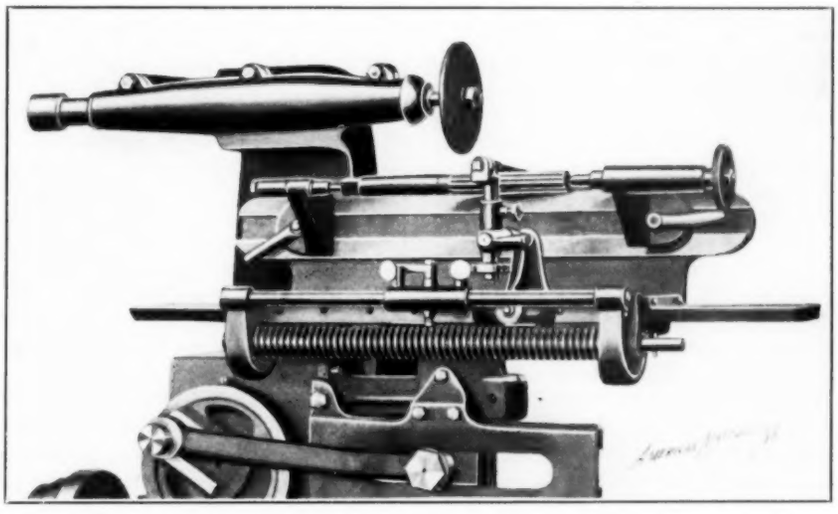


FIG. 2. AUTOMATIC CUTTER GRINDER.

Echoes from the Oil Country.

EXCEEDING ORDERS TO MAKE WORK RIGHT.

"What will you charge to bore out a cylinder and put in a new piston head and rings and rod? It's an old-style Tifft and is in pretty fair shape, only it needs boring out, and I can just bring the cylinder in and save hauling the rest of the engine." Mr. Moore was a regular customer and brought all sorts of jobs in.

"Yes, I know $15 is your regular price, but I bring in quite a lot of work and always pay for it as soon as it is ready for me and I think I should be favored a little."

"Suppose we call it $14 with you then; how will that suit you?" I replied.

"I think that is plenty for the job, but I'll bring her in and I'll expect a first-class job, and I may have several more to do later," and out he went.

In due time the cylinder was brought in and left in my hands to put in good shape.

The valve was a "rocker," with the

chest as part of the cylinder casting. The valve stem was flat where it fitted into the valve and was very loose in the valve and also in the yoke that supported the outer end of it. This meant lots of lost motion and a very poor steam distribution and it was doing more to hurt the engine than the wear in the cylinder, which was not very bad. The owner was gone before I discovered the shape the valve was in; indeed I found out how it was only by starting to take the bonnet off because it was in the way in boring the cylinder. That cylinder was promised for the next day; the man's wells were standing; no way to get word out to him; and I decided to fix the valve stem as well as bore the cylinder, and it took a new valve stem forging. I trued out the slot in the valve, fitted the forging to it, centered the stem by the valve, and turned it up and fitted the crank on. A new brass half box in the yoke on the bonnet completed the job, and all for a cost of $3.35. In the meantime the repairs ha' been pushed along on the boring, etc., and 9 o'clock the following morning found us ready for the owner, who was on hand promptly, and after loading it on the wagon went into the office to settle. At this time the shop enjoyed the luxury of a bookkeeper, who came out to me with: "Say, Will, how about this job for Mr. Moore? I see you have turned in $14 charge for boring the cylinder and putting in a new head, rings and rod, and then there is a charge of $1 for a valve stem forging, a pound and a half of brass and enough time to run it up to $3.35; that makes $17.35, and he says he ordered only $14 worth of work done."

"I don't think he knew the shape his valve was in or he would have had it done. You explain it to him, and if he is not satisfied send him out here to me," and I continued with what I had in hand, while the bookkeeper returned to the place we dignified by calling it an office.

Evidently he failed to satisfy our patron, for in a few minutes I saw him coming for me with indignation in his eye and determination in his manner.

"How does it come that you charge me $17 and 35 cents for boring that cylinder?" he began, as soon as he got within speaking distance.

"We are not charging that for the work you ordered, but it was necessary to do some work on the valve motion to make a good job for you, and as you always want a good job I did it," I replied.

"That didn't need anything except what I ordered. I've had lots of engines fixed before and I know. It isn't safe to bring a whole engine to the shop or you fellows will putter around on it and run up a bill of thirty or forty dollars, and then it isn't a bit better than before you started on it. I guess you must have been wanting a job pretty bad."

Evidently someone was a trifle warm under the collar, as the teamsters say of their horses when they are worked hard, and thought he was being "worked." Showing him the old valve stem and explaining carefully just what I had done and why I had done it, did not cool him off to any noticeable extent.

He returned to the office and again I had a visit from the bookkeeper with: "He's very angry about that job; he says he will pay for it if we say he must, but he thinks it is no better than a steal, and he will see that it doesn't happen again with him or his friends. Can't we knock the extra amount off and keep his trade? He is good as gold about paying for his work."

"That work is good, honest work, and is worth more than all the rest of the job to him, and he'll have to pay for it. If he ever comes back and gives us to understand that he is only paying for what he orders I will be very careful to see that nothing else is done, but I believe my judgment is better than his on some things, and part of my business here is to use it. Don't drop one cent on the price; it is low enough now."

Finally I saw Mr. Moore depart, and the bookkeeper came walking my way, looking sorrowful.

"Too bad, too bad," said he, shaking his head in a doleful way. "That was an awful good customer, always paid cash, and helped us over pay day more than once; but that is the last of him; some other shop will get his work after this. Didn't say much when I told him he must pay the full bill, only: 'All right, sir; I can stand it if you can,' and away he went. Made me give him a receipt in full to date, though."

This happened on Saturday. Next Wednesday morning, on arriving at the shop, I found Mr. Moore there ahead of me. To my surprise he reached out and shook me cordially by the hand and appeared in the best of humor.

"Can you do a job for me right way so I can get it back home to-day?" he inquired.

"I can start it at once, but it depends on the job when I can get it finished," I answered. "What is the job?"

"Why, I'll tell you. I guess I was a little hasty last Saturday about that valve job," said he, laughing, "and shouldn't wonder if I owe you an apology. It's the best thing that's happened to me for a long time, your fixing that valve. That engine runs with half the steam any other one I have will. I didn't think it possible. I want you to fix this one the same way. It don't need boring, but I want to see what fixing the valve will do for it, and if it is improved like the other one was I am going to bring an entire engine in next time. I always supposed if the valve was reasonably tight and the cylinder was in good shape the rest didn't matter much and your talk didn't convince me. I thought you were just talking for the shop, but the way that engine runs settled the matter. Now, if you will just push this through for me you will be heaping coals of fire on my head." So we still kept our customer.

I learned one lesson quite young. If a job seems costly but gives first-class satisfaction you still have a friend and a customer, at least where the best work is wanted; but if a job is poor and fails to give reasonable service, no matter how cheap the price, it is remembered long after the cost of the other one is forgotten, so that a job should always be good enough for its purpose, no matter what the cost; and it is much safer to do it a little too well than the reverse.

We received an engine one day with very indefinite orders. It belonged to a wealthy producer—not a mechanic, but a hard-headed, shrewd business man. The teamster who brought it in brought what orders we had, which were: "The lease boss said the 'Old Man' said to send her in and have her fixed. When will I come for it?" We fixed it in the highest style of the art, not knowing just how well the "Old Man" usually had his work done, and it went out. The letter that brought the pay for the bill also brought the information that it was "out-rageous."

Personally the "Old Man" was a stranger, but hunting him up did not help matters. He did not care to discuss mechanics, but he could understand a bill from 50 to 100 per cent. bigger than he usually received when he sent an engine to a machine shop.

"All right, all right," he said, with a dismissing wave of the hand; "if a man beats me once, that is his fault; if he beats me twice, that is my own fault. Good day, sir; good day." Not very consoling, was it?

Some months after a team drove up with an engine on the wagon which the teamster said belonged to the same man, and that his orders were to bring it to us for repairs. He was positive that the lease boss had told him to bring it to us and had heard him say there were more to come as soon as that one was done. We unloaded it, but, thinking still there was some mistake (the place was still tender that had been roasted) we did not do any work on it until the owner was hunted up. He did not waste words.

"Fix that engine up like you did the other one."

"If it is in as bad shape as the other one the bill will be as large as the other one, if I do the work as well," I ventured.

"Do it right," he returned. "I would rather pay too much and get *something* than to pay a reasonable price and *not get anything*. Do all of my work as well as you know how; I have several to send in."

We did them, and I also saw the lease boss and asked how it came that we got them after the kick on the first one, and

when they were much nearer to several other shops.

"It was just about this way. Maybe politics or something made him order the first one sent up. The other shops all know him, and they all try to do the work as cheap as possible, as he watches things close. As he is gilt-edge pay, they all like to get it. One day he came out and was looking around finding fault as usual with most everything, especially with the engines. Not a knock but he noticed it. Most of them had been to the shop for some repairs. Finally he came to the one you fixed; it was running very nicely. 'I guess you forgot to send this one in to the shop, didn't you?' says he. I told him you had fixed it. I guess every other engine he saw was out of shape in some way. Just before leaving the lease he turned to me and says he: 'You just send these engines in as fast as you can spare them and have them fixed like the one over on No. 10, and send them to the same place you sent her.' I had to haul some of them a good ways, but you got to do as the Old Man says if you keep working for him."

We find it isn't safe to do a poor job even if that is what a customer wants. He sometimes forgets he ordered it done that way, but I never knew one to forget the shop that did it. W. OSBORNE.

Oval Chuck.

We illustrate herewith an oval chuck made by Gould & Eberhardt, of Newark, N. J. This chuck can be fitted to any lathe and is intended for such work as elliptical dies used by jewelers, silversmiths, electrical instrument manufacturers and others. The circular plate *A* in front, which has a threaded nose for a chuck or fixture for holding the work, is carried at the front of a pair of slides mounted at right angles to each other. The front slide *B* fits in a guide planed in the face of disk *C*. This disk, which has a hub extending back inside of the mechanism at the front of the headstock, and screwing on the nose of the lathe spindle, acts as a driver for plate *A*.

The rear slide *D* fits in guides secured to the back of slide *B* and is bored out and mounted on a guiding ring turned up on the face of an adjustable block or frame *E*. Directly back of *E* is a block *F* which is bolted fast to the front end of headstock. A tongue on *E* fits in a groove in *F*, and by means of adjusting screws, one of which is shown at *G*, frame *E* can be drawn either toward the front or back of the headstock. Thus the guiding ring on *E* can be set either concentric or eccentric to the lathe spindle. When frame *E* is moved back until it strikes a stop-pin in the rear, the guide ring will be concentric to the lathe spindle and the slides *B* and *D*, revolving about the same center, the work produced will be circular. When the guide ring is adjusted toward the front and becomes eccentric to the spindle the slide *D* which must revolve upon the ring moves slide *B* in the guide planed in the driver *C*, and an elliptical job is the result. The greater the distance the guide ring is offset from the center the greater will be the difference between the major and minor axes of the ellipse. The chuck plate *A* can be rotated on its slide by means of the worm at *H*. This adjustment is a great convenience in resetting work in the chuck. Some of the outlines traced by a lathe tool on plates held in the chuck are shown in Fig. 2.

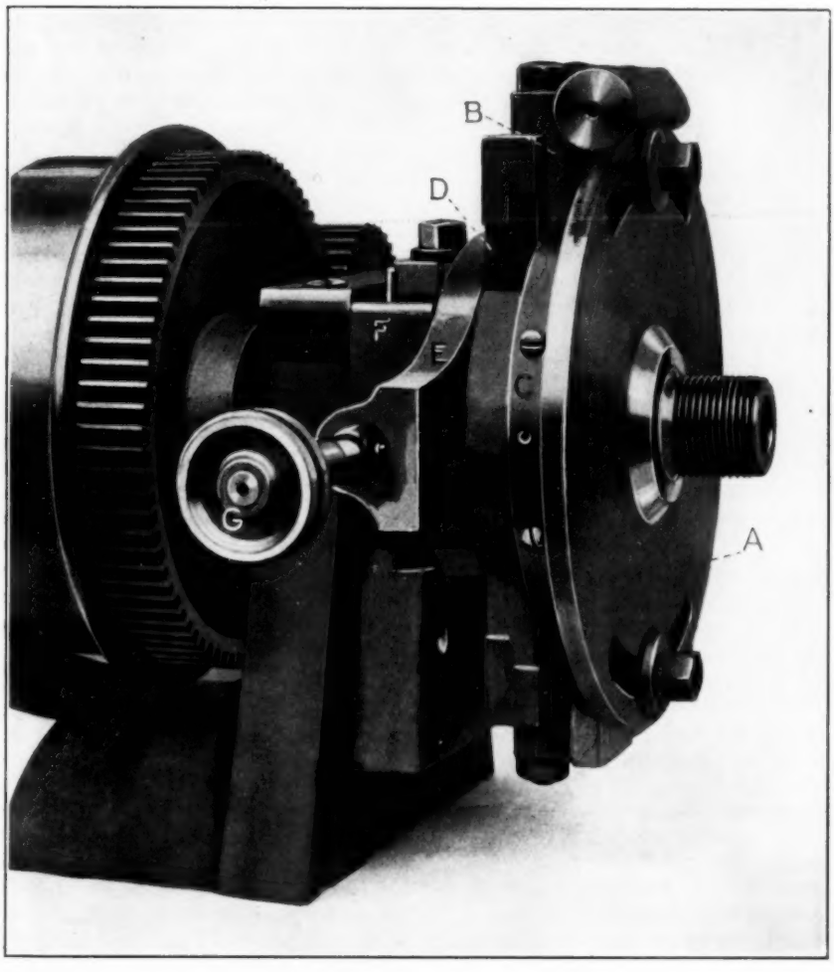


FIG. 1. OVAL CHUCK.

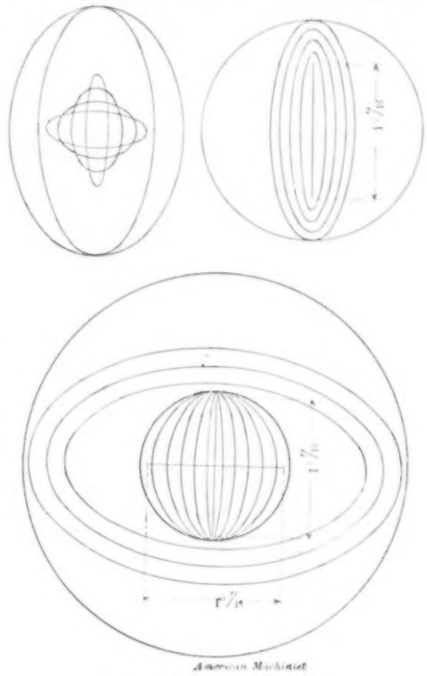


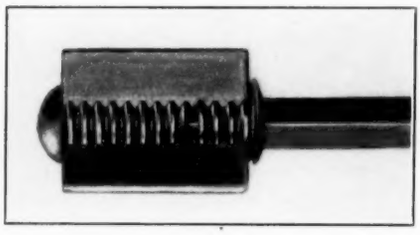
FIG. 2. OVAL CHUCK WORK.

People are apt to think of natural gas as costing nothing and to regard as specially favored the manufacturers who are located in the natural gas belt. The gas of course has to be piped long distances, and often to be pumped, and the companies which control and deliver it must have their profits also. Prof. Henry G. Cox, of Indianapolis, has given some figures which show that coal is now cheaper than natural gas for power purposes. In a large manufacturing plant in Indianapolis with half the boilers using natural gas and the other half using coal with mechanical stokers, the coal costing $1.85 per ton delivered on cars at the boiler-room and the gas at 7½ cents per 1,000 cubic feet, there was a difference in cost of 30 per cent. in favor of the coal.

A New Set-Screw.

The illustrations herewith show a set-screw that is designed to take the place of both the headless and the square-head set-screw.

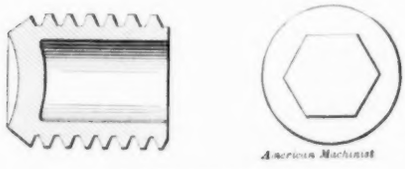
One length of each size is all that is needed for any depth of hole. It is made of steel, drawn with a polygonal hole,



NEW SCREW AS A JIB SCREW.

preferably a hexagon. Being hollow gives an elasticity that is desirable in many instances and prevents the screw from loosening when subjected to great changes of temperature. As it is short and elastic, the effect of any variation in the lead caused by hardening, is reduced to the minimum. By putting two screws in a hole they are locked and at the same time the strain on the thread is equalized throughout the length of both screws. The half-tone shows the screw as a gib screw. The locking of the gib screw is accomplished by the short section of a screw without a bottom, so that the hexagon driver may be inserted to loosen the lock-screw, then pushed through to engage the gib screw to adjust it. This does away with two wrenches to adjust a gib screw, and does not pull the screw away from the gib as frequently happens with a screw on which a lock-nut is used. It also allows a gib screw to be locked without projecting; this is a very desirable feature. The hexagonal driver gives a maximum strength and driving power and can be used in corners where a screw-driver or a wrench, with slotted and square-head screws cannot well be used.

Actual tests on C. R. shaft 1 15-16 inches diameter show that two 5/8-inch 11 U. S. S. hollow screws in a hole 1¾



A NEW SET-SCREW.

inches deep hold 50 per cent. more than a solid square-head screw with a lock-nut. One screw in a hole 5/8 inch deep held more than twice as much as a slotted screw tightened with a wrench on a screw-driver.

It is obvious that there is no way of damaging a screw of this kind so that it cannot be removed. The process of making this screw is the subject of a patent recently issued to our contributor, W. A. Warman.

The Electric Arc for Cutting up Metal.

On the fifteenth floor of the tower of the Auditorium Building in Chicago there were until recently four water tanks, 8 feet in diameter and 12 feet high. These tanks had not been used for a long time and it became necessary to remove them. The job was attempted by familiar mechanical means, but proved to be too slow and costly, the noise also not being permissible. The tanks have now been cut up into pieces of suitable size for handling by the use of the electric arc. The cylindrical shells were each cut into six pieces and the bottoms into two pieces. Three equidistant vertical slits were made and two horizontal slits besides the cut across the bottom. The iron was a little over 3/8 inch thick, and the first tank was cut up in seven hours. An anthracite carbon, 1 inch in diameter and 1 foot long, was used, one terminal of the circuit being attached to the tank and the other to the carbon, the latter having a suitable handle, and the eyes of the operator being protected by three pairs of blue goggles with pieces of black cloth between the glasses. The metal is melted at a white heat, the arc formed being 2½ to 3 inches in length, and after it penetrates the shell the molten metal squirts out about 15 inches. A hole was put straight through the shell in 4½ seconds, and the slits were cut at the rate of a foot in 2 minutes. In cutting 465 feet only two carbons at 25 cents each were used. The 110-volt direct current of the building was reduced to 30 volts, and only 75 to 80 amperes were used. Besides these tanks Mr. Haschke, who did the work, has cut an 18-foot length of 15½-inch wrought pipe, 3/8 inch thick, into three sections, making a cut in 8 minutes. For the above interesting particulars we are indebted to the *Western Electrician*.

Foreign Markets for American Machinery.

Turkey continues to offer a very good field for foreign manufacturers. For example, there is just now an excellent demand in the district of Adana for cheap engines and also for machines to gin cotton grown in the plains. There are already some twenty cotton ginning establishments worked by machinery exported thither from England, either hydraulic or steam power. As the neighborhood of Adana is traversed by three fine rivers, besides smaller streams, there would probably be a demand for irrigation machinery if a few cheap machines could be imported and erected as samples. Adana is only 2½ hours by rail from the port of Mersina, which is well served by a number of steamship lines from Europe. Egypt is steadily developing her resources, and the country offers a capital field for the makers of machinery of various kinds, farm implements of all descriptions, etc. There is a good opening for a cheap water-raising apparatus, to obviate the existing "shaloof" system, by which six men are required to hoist the contents of six buckets of Nile water to the top of the bank, whence it is conveyed to the cultivated land—the whole process being exceedingly tedious and wasteful, but one universally employed by the peasants, who have no other means of raising water. It is expected by shrewd observers that the development of Egypt will in the near future be greater than any since 1882. The lack of fuel has been a serious obstacle to the expansion of Egyptian industries, but the discovery of petroleum near Suez, and the cheapness of labor, will soon enable factories to be started, and with that will come a demand for various kinds of machinery.

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From a perusal of the new Australian Federal Tariff (revised to February 1 last) it appears that machine tools for bookbinding, boot making, brush making, glass making and working, hat making, metal working, brick making, and tools used in trade will be admitted free. Screws which were to pay 30 per cent. duty are now placed on the free list. Important exemptions are made as regards mining machinery. The Federal House of Representatives has decided to place a duty of 20 per cent. on engines and boilers, on pumps, and on other machinery, including gas engines, sheep shearing machines, portable engines fixed on a locomotive boiler horizontally, with wheels and shafts, suitable for transport; traction and oil engines are to be admitted free, instead of an original 15 per cent. duty.

. . . . . .

England is a splendid market for American boot-making machinery. At the last great exposition of such machines held in London it was evident that your manufacturers hold the greater part of the trade. Indeed, it is estimated by the boot trade that every shoe sold in England today pays a royalty in one form or another to the owners of the American patents.

. . . . . .

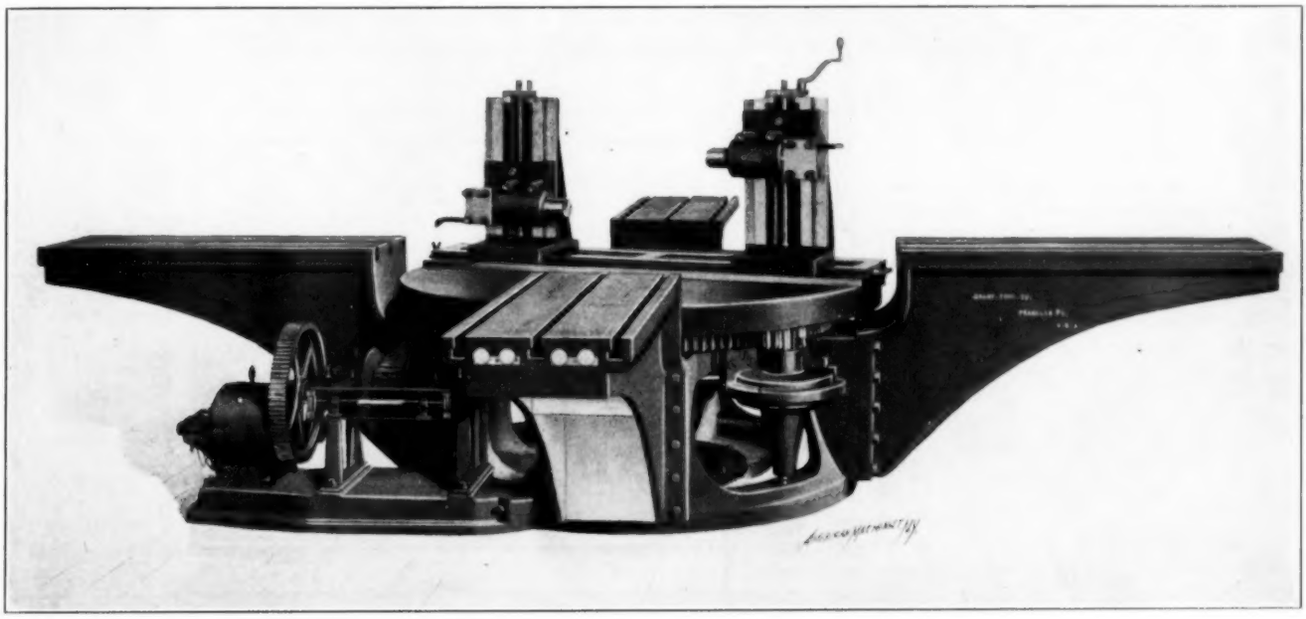
Most people who have an intimate knowledge of the South African markets agree that the main demand in that country is coming a year or so ahead rather than now or in the immediate future. Then it will be very great. Johannesburg will probably for the time be the biggest market for machinery in the world. Indeed, the mining plant wanted on the Rand alone within five years will probably cost $150,000,000, and a great deal of the mining-machinery business is in American hands, many of the mining engineers and managers being American. On the other hand two of the leading groups of mines—the Wernher Beit and the Farrar groups—place all their orders possible in England.

The Abu group place their orders in Germany, as they are run by German interests. Already orders are being placed in England to some extent, and one of the latest was for four of the largest locomotives which have ever been landed at Cape Town. The mining manager of one of the large groups recently stated that other things being equal, British makers would be given the preference. "But we cannot afford to buy English manufactures," said one large buyer. "They are often 20 per cent. dearer than German and the latter are greatly improving their machines. The delays of the British makers have also seriously affected their position in South Africa. For instance, some time ago £60,000 worth of steel piping was urgently wanted in Johannesburg, and this could not be had from England except in installments extending from four to nine months, while an American firm delivered the lot in three months. So it was with a big order for over 240 30-ton steel trucks, of which 167 were made in the United States, English makers being unable to deliver quickly enough." F. C. C.

London.

Gallery-Plate Boring Mill.

This machine was built for Allis-Chalmers Company (E. P. Allis's shops) for finishing the gallery plates of their large vertical engines, and is intended to finish at one setting the two sides and bore the center to exact dimensions. As will be seen, the machine is of the vertical type and has a heavy table or face-plate to which is attached a cross slide having uprights carrying vertical slides with tool holders that can be adjusted in all directions. The face-plate has a gear at the periphery and is driven by an upright shaft, which is in turn driven by worm gearing. A Milwaukee Electric Company's 5 horse-power motor transmits the power through a Reeves variable speed shaft at the left. The table runs in a horizontal track at the periphery and has a center bearing 18 inches diameter at the top and 10 inches diameter at the bottom. The boxes are taper sleeves adjustable for wear. Around the center bed are bolted four knees having T-slots for fastening the gallery plate to be bored and turned. These knees extend to the periphery of a circle 19 feet diameter. The diameter of the table is 7 feet 6 inches. The horizontal feed of each upright is 28 inches and the vertical feed of each tool slide is 18 inches; all feeds are by power and variable. The weight of the machine is 20,275 pounds. It was built by the Grant Tool Company, Franklin, Pa.



GALLERY-PLATE BORING MILL.

Report of an Employers' Association.

We have received a copy of the Annual Report of the President and Secretary of the Employers' Association, of Dayton, Ohio. It is interesting alike to employers and to employees, as showing what may be done by an organization of employers which, in the courts, at the polls and in all departments of a city government, seeks to have things go as it wishes them to. The character of the report may be inferred from one of the opening sentences, which is as follows:

"Permit me to say that, while I intend this as my a nual report, I wish to embrace in it more than a report, and to make it a plea for greater unanimity of action by employers, more interest in the work of organization, a stronger realization of the great danger which confronts American trade and industry, our manhood and our rights of citizenship, by the greatest, most tyrannical and most unlawful trust the world has ever known, guided as it is by the hands and minds of trouble-breeders, agitators, socialists, anarchists, without regard for law and order or the rights of others; men who, to make more certain their own importance and calling, persistently labor, aided by unscrupulous politicians, to undermine the pillars upon which our government rests, and to secure the enactment of laws which will grant to organized labor license to enforce employers into submission to whatever demands its turbulent and irresponsible element may see fit to make upon them, such demands being restricted only by the limitations of their own imaginary power."

That the president of this association believes (no doubt sincerely) that his way is the only way, is shown by his reference to the Civic Federation, whose good work in settling industrial difficulties has been several times referred to in these columns. On this point the report says:

"Permit me, now, to call attention to the lately formed Civic Federation, the purpose of which is to settle labor controversies in which national labor organizations are interested. I have no desire to criticize the wisdom of the men engaged in this important work, but I cannot help but believe that no lasting good can come of this movement, and that the only permanent and satisfactory way in which to settle a controversy with organized labor is to have absolutely no dealings with it, and, while I fully realize what, in many instances, this means, yet all my observations, of thirty years or more, lead me to believe that such policy is the only one which will insure permanent relief from its unjust encroachments."

A copy of this report should be kept on file in the offices of some of our esteemed foreign contemporaries whose editors and contributors evidently think that no labor organizations worth mentioning exist in

America and that the problem of dealing with them does not present itself to the American employer.

Artistic Die-Making.

BY JOSEPH V. WOODWORTH.

As a rule it is popularly supposed that the finer classes of die work can be turned out only in shops equipped with the latest improved tools, and if one were to say that many of the shops in which the finest of such work is done possess only such machines as are to be found in any little country jobbing shop, he would be laughed at. In the city of Brooklyn, on one of the busy streets near the river front, there is a little jobbing tool shop about 30x60 feet. The proprietor is a German and the machine-tool equipment of the shop consists of: One medium-sized lathe, a speed lathe, a shaper, two drill presses large and small, an emery wheel, a forge and an old German screw press. There are six men in this shop: one is an engraver and die sinker, and the others are die and tool makers. The class of work turned out in this shop will bear favorable comparison with that turned out in any other shop in the country, and, what is more, they turn it out at a good profit for the "boss." This little shop has been in existence for a number of years and I spent six months in it a few years ago, and while in the vicinity the past winter I paid the "boss" a visit and found the same old tools working away and turning out more work than ever. While the "boss" was talking to me he noticed that the shaper was idle, so he called out: "Jake, dake dot bolster und blane it up while der shaper is *useless*." That gives you a picture of the boss.

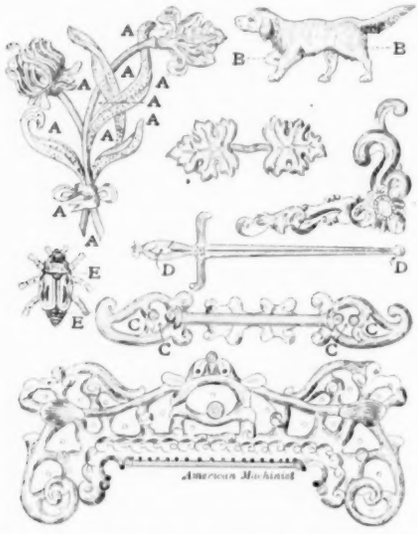


FIG. 1. EXAMPLES OF EMBOSSED, PIERCED AND BLANKED DESIGNS IN THIN SHEET BRASS OR COPPER.

While there I made note of a number of dies going through and also of some finished and about to be sent out. I here show examples of work and types of dies which are remarkable principally from an artistic standpoint and at the same time for the principles of construction adopted. In Fig. 1 are shown some examples of artistic die work as produced in dies made in this shop. The flower design, shown at the top at the left, was produced in three operations; embossing or striking up the design, piercing or punching out the sections marked *A*, ten in all, and trimming and punching out the finished piece. The embossing die is not shown, as its construction will be understood from the other cuts. Fig. 2 is a plan of the piercing die. The punch for this die consists of the regular cast-iron holder and machine-steel pad in which the ten piercing-punches are located, after which solder is run around them at the face of the pad. These punches are left soft and when dull are upset so as to punch clean again. Fig. 3 is a plan of the blanking and trimming punch for the finishing operation. It is fastened to the holder by two flat head

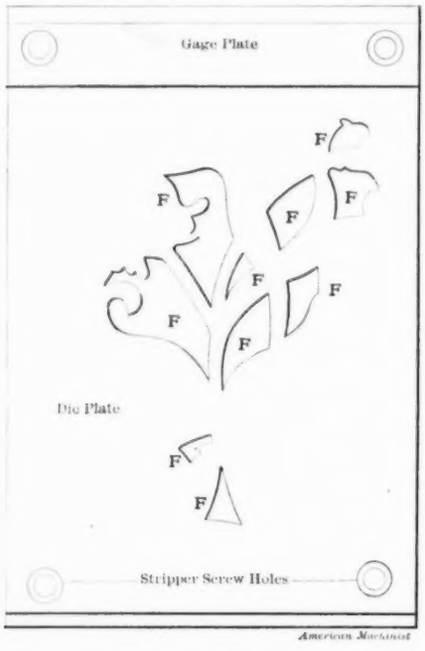


FIG. 2. PLAN OF PIERCING DIE FOR FLOWER DESIGN.

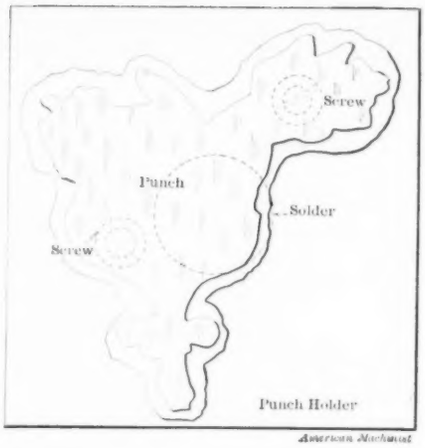


FIG. 3. PLAN OF BLANKING PUNCH FOR FLOWER DESIGN.

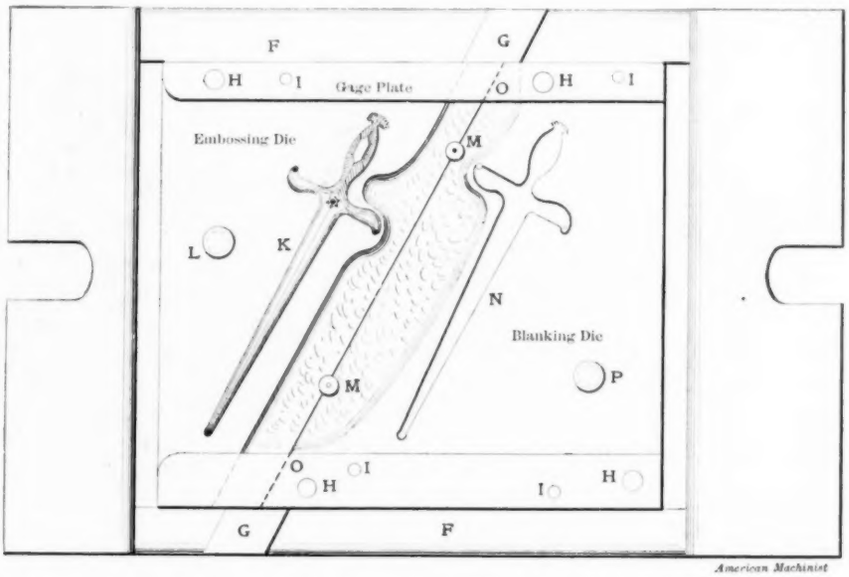


FIG. 4. PLAN OF COMBINATION EMBOSSING, PIERCING AND BLANKING DIE FOR SWORD.

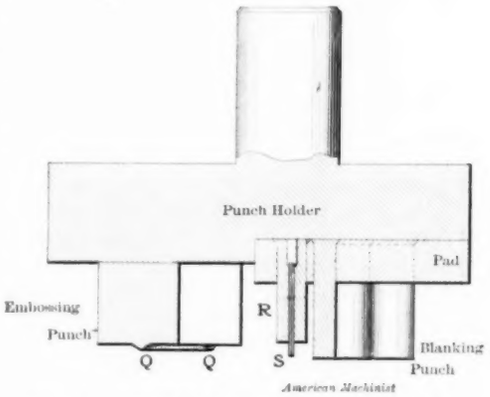


FIG. 5. VERTICAL SECTION OF PUNCH FOR SWORD DESIGN.

screws let through from the back, after which solder is run around the face, as shown by the irregular line around the punch. This punch also is left soft. Any

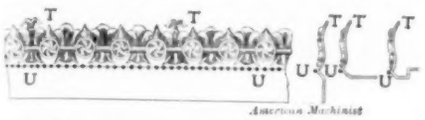


FIG. 6. SECTION OF EMBOSSED BORDER, 36 INCHES LONG—FIRST OPERATION.

diemaker who has made many dies in which gangs of piercing punches had to be located will appreciate the skill required to locate ten irregular shaped punches, as in Fig. 2, so as to have them in perfect alinement with the dies.

Fig. 4 is a plan of a gang die used to produce the sword shown in Fig. 1 in one operation. The work to be done consists of embossing or striking up the design at *K*, then moving the metal one space and piercing the two small holes *D D*, Fig. 1, at the dies *M M*, and lastly blanking out the finished piece at the blanking die *N*. The construction of this die is shown plainly in the engravings, and very little description is necessary. The embossing die and the blanking die are two pieces of tool steel with one end of each finished to the angle on which the dies are laid out. The two pieces of steel are fitted to the bolster in a seat between *F F*, and are located with their inner ends tightly together by strong taper pins at *L* and *P*. The piercing dies are two tool steel bushings, hardened, ground and lapped to size, and forced into holes in the inner faces of the embossing and blanking dies.

The punch used with this die is shown in Fig. 5. The blanking and piercing punches are located in a pad, while the embossing punch is located on, and fastened direct to, the face of the holder by screws and solder not shown. The piercing punches, because of their small diameter, No. 60 drill, are forced into supplementary holders *R*, and are allowed to project beyond the face sufficiently to allow of their passing through the stripper and stock and entering the die. The pad is fastened to the holder by four flat-head screws, not shown. The blanking punch is made longer than the others, so as to pass through the stock and enter the die before the other punches touch the stock, thus preventing an unequal drawing of the metal by the action of the embossing punch, and also insuring the proper locating of the "follow" operations on the work, as it is fed along the die face.

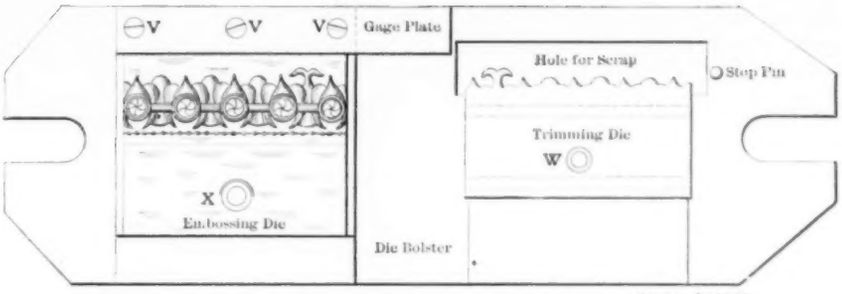


FIG. 7. PLAN OF COMBINATION EMBOSSING AND TRIMMING DIE FOR FIRST OPERATION ON EMBOSSED BORDER.

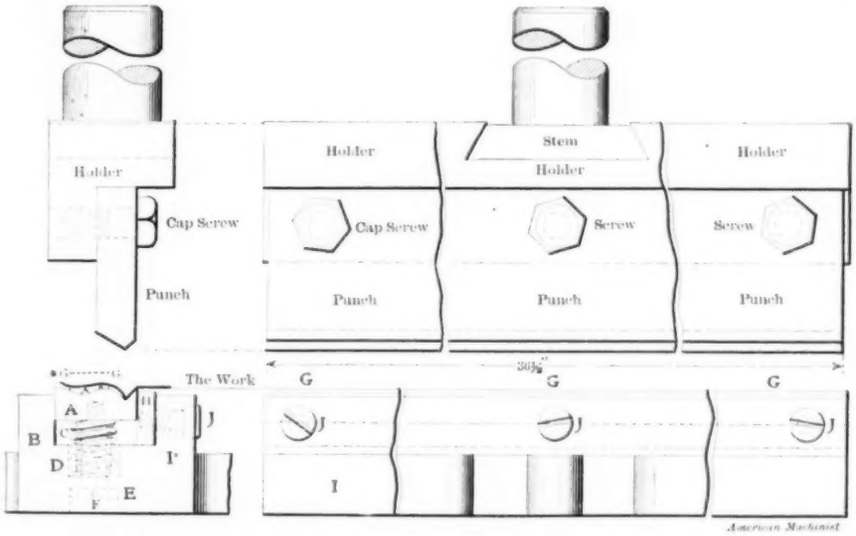


FIG. 8. BENDING PUNCH AND DIE FOR FINISHING OPERATION ON FIG. 6.

In Fig. 6 we show a section of an embossed border which was produced in strips 36 inches long by the gang die, Fig. 7. The strips of metal are fed from left to right and are first acted upon by the embossing punch and die and then fed forward and trimmed. The stripper is located on the trimming punch and is of the usual spring type. The embossing die and the trimming die are located in dovetailed channels in the bolster by taper pins at *X* and *W*. The points *T T*, in Fig. 6, are the gage points for locating the work in the proper position on the trimming die, the stock being fed forward until the point strikes the stop-pin.

To finish these embossed strips, so that four of them will form a picture frame when soldered together, two bending operations are necessary. The results, after these operations, are shown at the right end of Fig. 6, while the dies used to accomplish the results are shown in Figs. 8 and 9.

The punch and die for the first bending operation are shown in Fig. 8, giving an end view and a front view of both sections. The punch and die for the second bending operation are shown in Fig. 9. The manner in which the work is located and bent may be understood from the end views of both sets of tools, in which the work is shown by heavy dark lines as located upon the die in position for bending. These dies were 37 inches long, and when it is considered that they were machined and finished in an 18-inch stroke shaper, it will be conceded that considerable skill

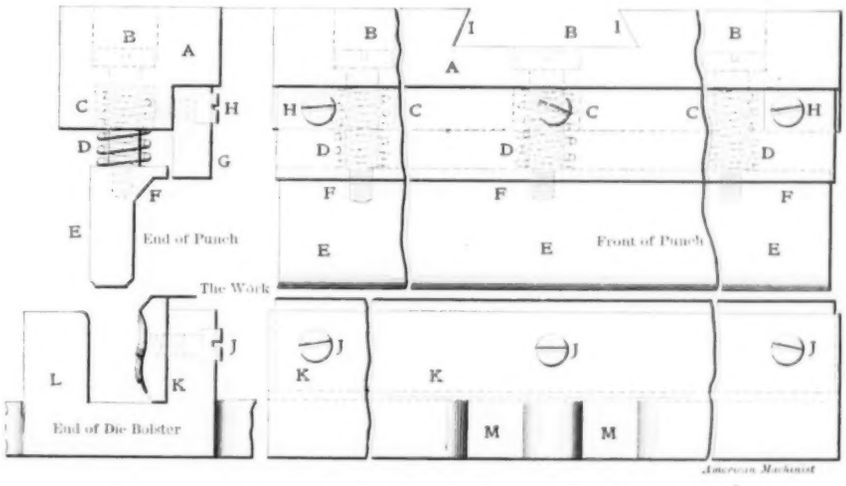


FIG. 9. BENDING PUNCH AND DIE FOR SECOND OPERATION ON FIG. 6.

was involved in the accomplishing of the desired results. All working parts of these dies, except the spring and fastening portions, and the holders were of tool steel and were left soft, as the shop did not possess the necessary facilities to allow of their being hardened.

The animal design, shown in Fig. 1, was produced in one operation by means of a die similar to Fig. 4, the work done comprising embossing, piercing two holes at *B B* and blanking out the finished piece. The beetle, shown in the same figure, also was produced in a die of this construction, there being two holes pierced at *E E*, the stock used being thin sheet copper, while for the dog, brass as used.

The maple leaf design was produced in one operation by an embossing and trimming die.

The piece at the bottom of Fig. 1 is the best of the lot, and required but two operations. In the first operation the metal was embossed and the piece was blanked out, while in the second the portions worked by the dots were pierced. The making of the blanking and piercing dies for this piece was a job worthy the skill of any diemaker, as the piece had to be produced clean and free from burrs, fins and irregular margins. In the piercing die twenty punches were used. They were all let into and fastened in a machine steel pad and solder run around the face of the pad.

When it is considered that the people who go to this little jobbing shop to have dies made do so because they can get them cheaper and as good as if they went to some of the larger shops, and when the tool equipment of the shop and the classes of dies produced in it also are considered, the skill of the men and the mechanical and business ability of the "boss" may be imagined.

A Formula for Success.

The man who runs the "Krank's Corner" in *The Foundry* says:

M. H. Treadwell & Co., who operate a foundry at Lebanon, Pa., have issued a little folder which gives the following formula for "sure success":

30 per cent., Patient, persistent dig, dig, dig, at it every minute.
30 per cent., Reputation (founded on fact) for honest dealing every time.
10 per cent., Luck and fortunate circumstance caught on the fly.
20 per cent., Snap.
10 per cent., More persistent dig.

100 per cent.—SUCCESS.

According to this program success is only attained by furnishing 40 per cent. of persistent digging.

Now I am sure this prescription does not apply to our foundries, although it is founders who advocate its use.

Some of the most persistent diggers I know have been digging for years. Maybe they have earned ten cents or so a day more than the balance of their fellows. They have had to spend this much to provide increased horse-power. So where have they gained anything?

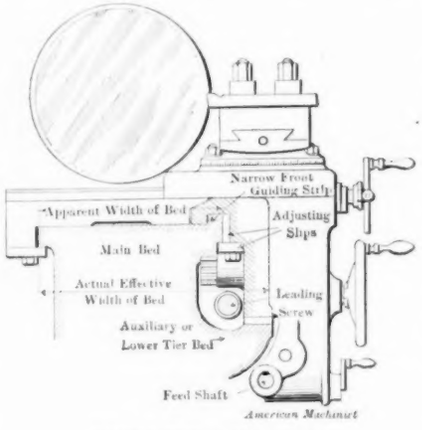
When it comes to selecting a foreman, does the old man pick out the molder who can put up the biggest day's work? Does he give the job to your persistent digger, the man who keeps his nose in the sand pile till the last minute? Very seldom does he do so. As a rule, he is more interested in finding a man who can jolly others into digging, than he is in finding a real digger.

I know owners of foundries who have worked hard for a decade and have nothing to show for it. They have worked far harder than any man in their employ. And alongside of them are other foundrymen who never have breakfast until eight o'clock and are able to spend their summers at health resorts.

All of which makes me think that while 40 per cent. of digging may be all right, the digging must be done in the right direction. One may dig hard enough only to find perpetual failure.

New English Lathe.

English tool builders, as well as our own, are feeling the effect of the new high-speed tool steels, which call for greater power capacity, in lathes particularly, and in *The Engineer* of recent date we find an English lathe illustrated of which we show a cross-sectional view taken from the columns of our contemporary. We have left the lettering on this section as given in the original and this probably sufficiently explains the points claimed for the lathe. It will be noticed that the apparent width of the bed is much less than the real or effective width and there is supposed to be some virtue in this arrangement. Just what the advantage of it is as compared with extending the upper bearing surface in front of the bed we do not quite clearly understand, but it is evident that the apron and apron mechanism are exceptionally well supported by the arrangement shown. The lathe is made by Darling & Sellers, Keighley, England, and has shown in tests very great pulling power and stiffness.



DOUBLE-TIER LATHE BED.

A Scheme for Making the Universal Dividing Head Universal.

The universal dividing head as we find it in the machine shop is frequently the source of no little annoyance. When you get a hurry job and want a special gear or special division, the chances are you will not have a special plate and maybe you have a dividing head not adapted to differential indexing without making a special rig. If your job is spiral, the differential won't let you out any way. Having had such experiences and others familiar to most AMERICAN MACHINIST readers, I thought there must be some easier way out of it. To many mechanics, of whom you would expect more, the dividing head is as great a mystery as the creation. What the index table tells them they will do, and that ends it. I suppose most of you have seen a man take off a plate with several circles of holes that would do his job to put on the one named in the table. I remember one man that I remonstrated with for doing that trick. He told me that he knew how to handle a dividing head as he had used a milling machine before I was born. The latter part of his statement was true.

The sketches show a device that eliminates most of the stumbling blocks for the stumblers and makes possible unlimited accuracy for careful and competent men. The device is: A plate, regulation size, with one circle of 20 holes numbered 1 to 20, the two sectors *A* and *B* and the arm *D*. Sector *A* has arc *C* sliding in a T-slot. Clamp *H* secures *C* when set. *C* is graduated to divide one space of the plate into 20 parts. *I* is a 20-pitch worm engaging a segment worm gear cut on *C*. Worm *I* has a graduated dial with 25 divisions.

K is a cam with a spring shoe bearing on the periphery of the plate, to lock *D* to the plate at any point. Sector *B* has a similar cam (*K'*) that serves to lock the two sectors to the plate. Sector *B*, after being set in the proper relation to *A*, is secured by clamp screws *S S S*.

The arm *D* has the hardened bushing *L*, to fit the index pin, the latter not shown except in Fig. 3. Sectors *A* and *B* are located at the holes designated in the table of settings, by removable pins. (Pins not shown.) Fig. 1 shows the device set for 175 divisions. After setting, *A* and *B* are clamped together with screws *S S S*

No. of Div.	Set A to	Set B to	Set Arc to	Set Dial to	Turns Crank Handle
125	1	10	8	0	5/25
175	1	8	11	10½	5/35

American Machinist

SECTION OF TABLE OF SETTINGS.

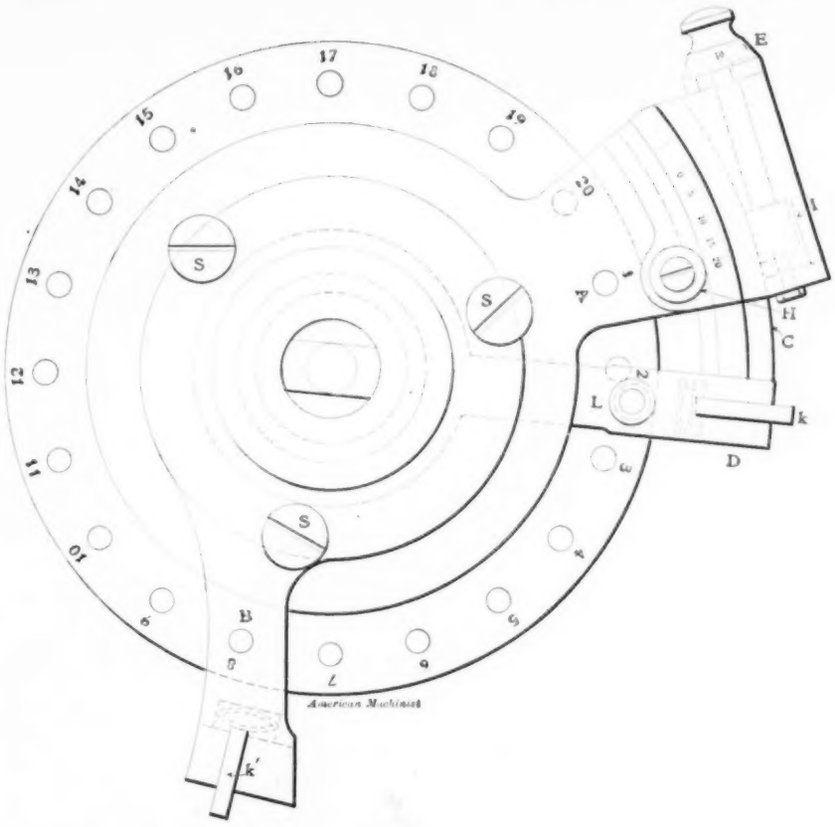


FIG. 1. UNIVERSAL INDEX-PLATE AND SECTORS. SETTING FOR 175 DIVISIONS.

and arc C is clamped at the proper setting, the sectors are locked to the plate with cam K' and the setting pins removed. To make a division move arm D (without removing the index pin) to contact with B and lock to the plate with cam K. Then unlock cam K' and move sectors until C is in contact with D and lock. This leaves it ready for the next division. If one or more turns are required, after making the part of a turn, as determined by the sectors, pull out the index pin and make the turns the same as with an ordinary index plate.

The things provided for are: No changing of plates; no adjusting of crank handle, consequently no bent or broken index pins; crank handle is fixed to the worm shaft; an easy setting and a plain table from 2 to 400 divisions inclusive; no counting of holes nor errors from mistakes in counting; adjustment for wear; possibility of great accuracy; an error of one whole division on the dial accumulated for 100 teeth would amount to 0.00025 of the pitch. For spirals, tapers and bevels the working is the same as the ordinary index.

Where the greatest possible accuracy is wanted it may be secured independently of the accuracy of the divisions because the mechanism can be set as closely as may be and then the work stepped around. If the last position corresponds precisely with the first, the setting is right, but if not, a movement of E equal to the error divided by the number of teeth to be cut will bring the setting just right independently of the graduations.

W. A. WARMAN.

Motor Boat Builders too Busy to Exhibit.

United States Consul Frank H. Mason, Berlin, two months ago gave some account of a special international exposition of motor boats and appurtenances to be held near Berlin from June until September of this year, and he urged American builders to exhibit. He says that "the response to this appeal, as well as to the prospectuses and correspondence sent out by the association itself to leading American boat builders, has been disappointing, the general tenor of such replies being that they are all busy with their orders at home, that their whole output for this season is sold, and that they have nothing to spare for exhibition purposes. This may be true, but it is a fair question whether neglect to utilize an opportunity like this will not be a repetition of the mistake which the makers of fire-extinguishing apparatus committed, when they failed to exhibit at the special exposition of firemen's appliances held here last year. The one American firm which did exhibit an electric fire-alarm system is now putting it in for the city of Hanover, and has under negotiation contracts for similar installations in other German cities.

"There is abundant evidence that a good representative American display at the motor-boat exposition this year would be an unusually promising investment for the exhibitors. It is fully understood here that our country is first and foremost in all that relates to the construction and use of motor boats as naval auxiliaries and for pleasure and business purposes. It is also recognized that Germany—the

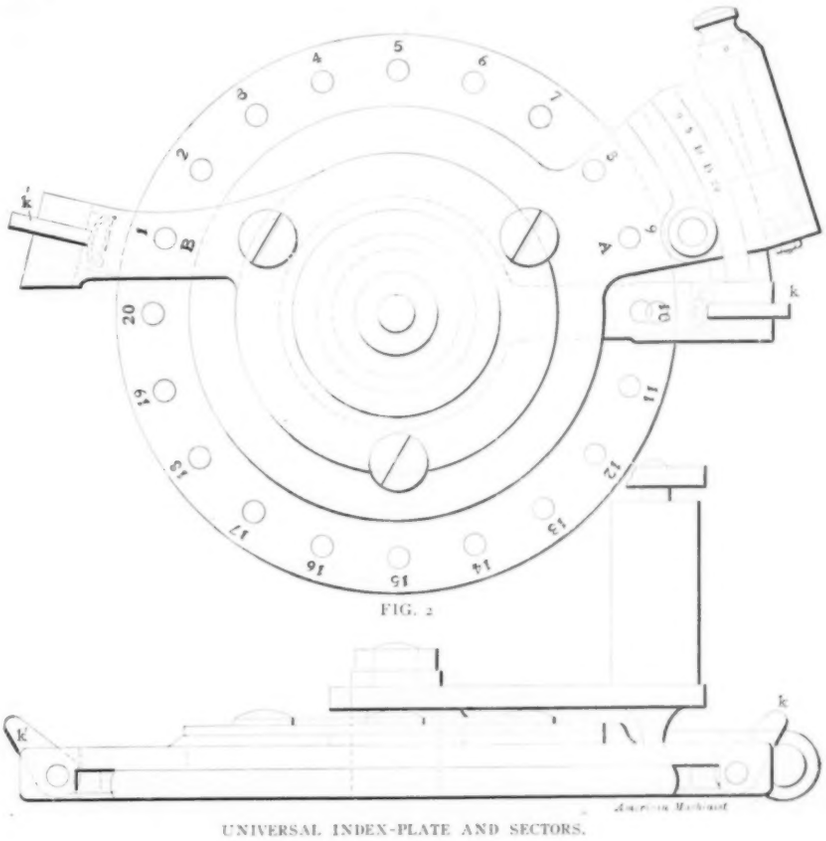


FIG. 2

UNIVERSAL INDEX-PLATE AND SECTORS.

original home of the gas engine—is so far behind in that class of water craft that the field is practically unoccupied. So many inquiries have been received by the committee about probable American exhibits—their tonnage, cost and other details—that there is evidence of a real demand, and the committee states that from all such indications, American exhibitors of standard types of motor boats, engines, etc., would be practically certain to not only sell their entire lists of exhibits, but to take numerous orders for future delivery. Responsible firms here and at the large German seaports are eager to accept agencies to represent American builders, and German machinists will be on the watch to purchase valuable patents in that class. Obviously, all novelties should be patented or registered and the patents applied for before being exhibited anywhere in Europe. It will be many years before another special international exhibition and classified competition of motor boats will be held in this country, and the present opportunity once lost will not soon recur. The committee authorizes the statement that every reasonable concession and assistance to facilitate a representative American display will be gladly and promptly accorded. Berlin is the center and mart of a vast system of canals, lakes, and canalized rivers which could be freely navigated by motor boats, where few or none now exist. If American builders will not reach out to grasp an opportunity like this, the builders of other countries—notably Great Britain, France and Belgium—certainly will."

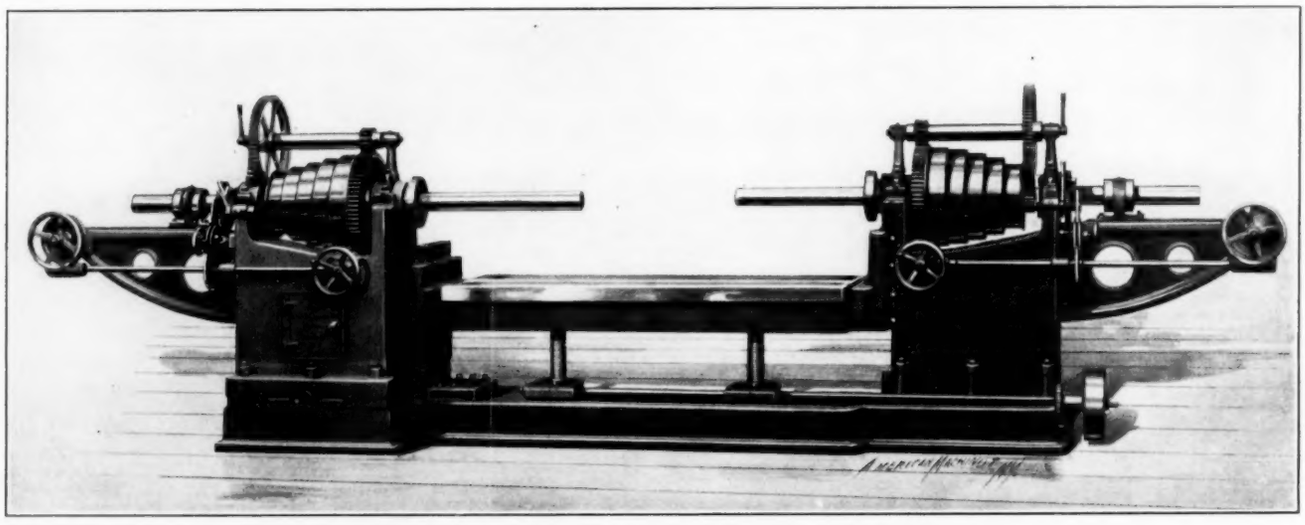
Double-Head Horizontal Boring Machine.

The accompanying half-tone shows a double-head horizontal boring machine built by the Binsse Machine Company, of Newark, N. J., for the British Westinghouse shops.

This is a special tool designed originally by the Westinghouse Electrical & Manufacturing Company for boring the bearings in the frames (steel castings) of their street car motors. The frame which encloses the motor completely—there being no openings except the four bearings for the two shafts—is made in halves. After they are planed, the two parts are bolted together and the bearings bored. Many thousands of these motors have been made, and accurate alinement is required to secure quiet running as well as interchangeability of parts. The first machines made for boring these frames had four sliding heads, which were fed up to the casting, two on each side, and bored all four holes at once. Clearly the accuracy of this operation would be greatly affected by any inaccuracy of the heads, and there being such a great number of frames to be bored, it would be very hard to keep these heads up in proper condition. In this double-head machine the casting is held in a cradle fixture, and the boring is done by two boring bars, guided in hardened bushings in the fixture, the bars being coupled to the boring bars of the machine. One head is fixed to the bed-plate, and the other has an adjustment crosswise, being bolted to a slide fastened to the bed-plate. The boring bar centers are thus set according to the distance between the motor shafts, and the heads are fixed during the boring.

The table which carries the cradle and casting is adjustable vertically by power and hand. The feeding mechanism is of the simplest character possible, being an adaptation of the Sellers friction disks. It will be seen that there is no wear to affect the alinement of the machine, other than that of the boring bars.

The general dimensions of the machine are as follows: Length over all, 25 feet; width, 5 feet; boring bar diameter, 4½ inches; boring bar feed, maximum, 51 inches; feed at one setting, 41 inches; maximum distance from bar center to table, 26 inches; minimum distance from bar center to table, 11 inches; cross-movement of head, 20 inches; table, 108x38 inches wide; total weight of machine, 25,000 pounds.



DOUBLE-HEAD BORING MACHINE.

Mr. Daunert on the Metric System.

Mr. Daunert, the New York representative of the Berlin firm of Schuchardt & Schütte, was born and educated in Germany but afterward lived and did business for some years in Aberdeen, Scotland. This with his stay in this country for several years past and his extensive experience in connection with machinery matters has led to his using both the metric and the English systems of measurements and weights. He gives it as his opinion that the metric system is much preferable in its simplicity and in the ease with which it is learned. He believes that the difficulties of its adoption are greatly overestimated and declares that it is at least as easy to think in metric units as in English units after a very little practice.

Bearing on the present discussion he recalls the experience in Germany in the adoption of their present decimal currency. When Mr. Daunert attended school in Germany the old system of money was in use and he learned that. Afterward when the present decimal system of marks div'ded into 100 pfennigs was proposed and adopted he said very many people kicked and swore and declared that it would be impossible to transact business with the new money; that nobody could understand it and that it would be the ruination of the country. But a short time after its a'option practically everybody agreed that it was a much better system and the difficulties they had imagined in learning the new system and in thinking in it disappeared almost as if by magic. He thinks that in the development of our foreign business and in a general way the adoption of the metric system here will prove to be a very great advantage.

Letters From Practical Men.

A Multiple Cupping Die.

Editor American Machinist:

I send you sketches of a die for blanking and drawing four cups or shells at each stroke of the press, the work being fed automatically to the dies by means of a roll feed.

The construction of the dies will be readily understood from the elevation, Fig. 1. The four drawing punches *F F F F* are held in the punch holder *D*, which is secured to the "second motion" or drawing plunger of the press by the slot in the stem in the usual manner. The punches are held in the punch back, as shown in the end view, Fig. 2. The cutting punches *G G G G* are fitted into the punch holder *E* and held by the set-screws *X*, the nuts *K* being used to adjust the cutting and the pressure necessary on the blank, to prevent its crimping in drawing. The die is fitted with a spring stripper so constructed that it can be forced up beyond the ends of the punches and then held by the set-screws to facilitate the setting of the dies.

The stripping process is assisted by the strip *I*, which is fastened on to the end of the die bed. The location of the dies *J J J J* is shown in the plan of the die bed. They are made separately, but are fitted into a die plate and also are seated into the die bed *L*. They are set staggering, to use the metal to the best advantage. To lay this out properly is quite a problem in itself, and the scrap is shown at the top of Fig. 1. Nos. 1 1 1 1 are cut at the first stroke of the press, Nos. 2 2 2 2 at the next, and so on. A certain amount of metal is lost at each end of the strip.

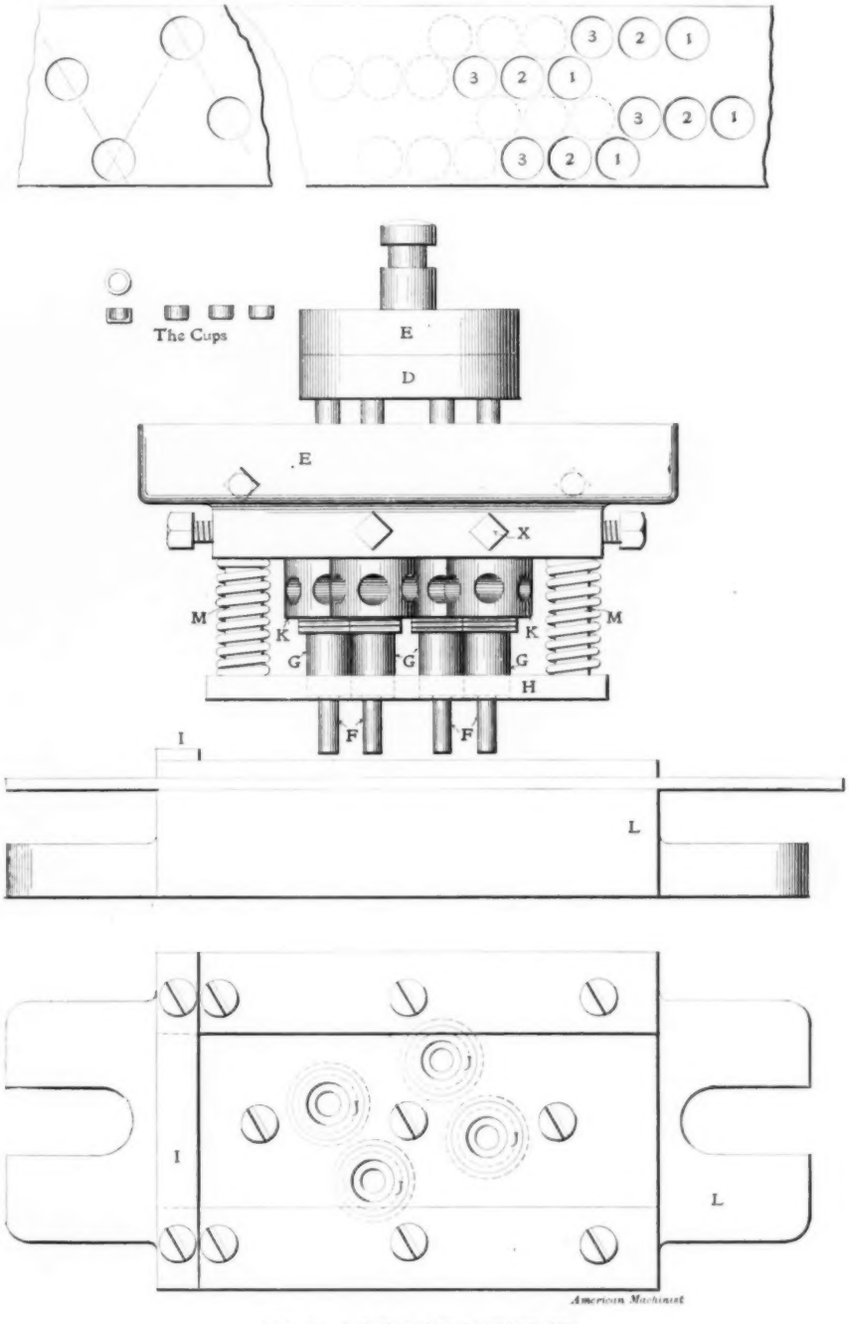


FIG. 1. A MULTIPLE CUPPING DIE.

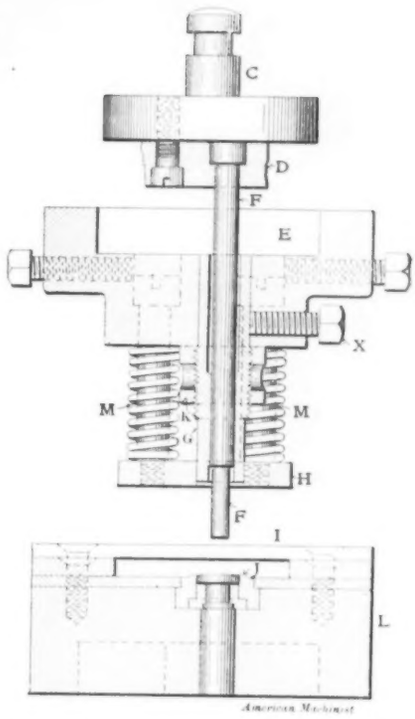


FIG. 2. END ELEVATION AND VERTICAL CROSS-SECTION OF MULTIPLE CUPPING DIE.

The punch back *E* is recessed at the top to allow the drawing punch holder to enter and so reduce the length of the punches as much as possible. Single action combination dies are also made and used in a somewhat similar manner, the press being inclined to allow the work to fall from the dies. As the dies are used principally for work that passes through a second operation, such as cartridges, burner work, etc., it allows the quality of the work to be slightly inferior to that produced by a single die. As to the economy by the use of dies of this kind, comment is unnecessary.

A. P. PRESS.

Giving Equivalents in Information.

Editor American Machinist:

A correspondent of the AMERICAN MACHINIST was asking a couple of months ago about the practical limits of accuracy for the boring of a 5-inch hole in a solid cast-iron hub 6 inches long, 12 inches long or 18 inches long; how the limits should vary for larger or smaller holes; how nearly straight and round in all parts it is practicable to make a hole by the ordinary methods of boring, etc. I don't see the replies to his queries piling in very rapidly, although we know well enough that there are several people who have experience and data along the lines indicated.

When you come to think of it, why should the letter to which I refer have elicited much information? The letter indicated that the writer was in the business of boring pulley hubs in large quan-

tities and that he was trying to "get it down fine." He of course is already full of information and experience in the line of work about which he inquires. He may be in a position to know more, and he may actually know more about boring pulley hubs than any other man in the country. He also acknowledges his indebtedness to the columns of the AMERICAN MACHINIST for "many valuable helps," and now he wants more at the price he has heretofore paid—nothing.

The proper way to meet such queries as these is the Yankee way of asking counter-questions: What are your present practical limits of accuracy in boring hubs of the dimensions you suggest? What are your ordinary methods of boring? Are your pulley hubs bored horizontally or vertically? Does the pulley rotate or the boring bar? In measuring for size and rotundity and straightness, what is the condition of the bored surface, and is any attention paid to the condition of the surface? In gaging or calipering, do you have more or less spherical points that will drop into any depressions of surface, or do you have long bearings that will straddle the furrows made by the tool?

The natural way when you are in trouble and want some help from a friend or when you want to find out something that he is likely to know, is not to rush at him and deliver your question or your demand point blank, but to tell your own story first, usually with considerable detail and circumstantiality, and so to lead up to what you want. Now, I am sure that the AMERICAN MACHINIST readers are friendly and helpful folk, and it would be proper to treat them as friends naturally would and should be treated. I know from the hints given in Mr. Ahara's letter that he could make up a valuable and interesting story about his pulley boring practices and experiences, and by letting the mechanical world know what he is doing and how he is doing it he will be taking the surest way in the world towards getting anything additional or corrective that others may have to tell or may be stimulated by his revelations to think up and suggest for him. I hope he is not so simple as to think that he has any trade secrets that it is policy for him to withhold, and that while withholding them he can get others' secrets for the asking. Ever since the AMERICAN MACHINIST has been going its readers have been swapping stories about their work, and each as he has had the opportunity has been continually showing something a little better in means or method or in result, and to this practice much of the advance in modern machine practice has been due. There is not likely to be much change in the way of progress, and those who want to get along must get into the way already existing.

I am not quite sure that our friend is really asking his question in the right form, anyway. I don't think it is necessary to inquire much as to the accuracy with which holes in the hubs of pulleys can be bored because I am of the opinion that without much expense or special care they can be and are bored quite as accurately as ordinary circumstances demand, and the real question is merely as to the minuteness that may be demanded, with a practical certainty that the demand can be easily satisfied. The real question is not how good a job can be done, but how good is good enough. There are lines of work where good enough is still out of reach, but the boring of pulley hubs can be too well done for profit, while still no better than good enough would have been.

The habit attributed to the Yankee of asking question for question is often spoken of slightingly; in fact, it is quite generally misunderstood. It is in no degree reprehensible, but is rather to be commended and cultivated. The asking of the counter-question is not usually done to parry the questioner, but rather to draw him on. It does not, to one who understands it, in the least suggest a withholding of information, for the American, as we all know, is free enough about telling things. He does, however, believe in the doctrine of equivalents. He does not expect either to receive or to give something for nothing. He says in fact "I'll tell you if you'll tell me, and be very glad to do it." After the communication both have usually gained something without either having incurred any obligation or lost any valuable. With this understanding of the conditions of the game those who comply with them have every right to ask questions and to expect the best possible answers to them. There is a fine chance for some practical experimenting here. It would be very proper for Mr. Ahara himself to try it. As his query has not brought him just what he was asking for, let him try it again by giving his experience and by telling what he does know in the line of his inquiry, so that those who would be able to answer him and who would be glad to do so will know just what will fit his case. Others who have not had good success in getting answers to general questions might also experiment in this line by giving first all the information they have or all the experience that has come to them, and it will be vastly easier and much more likely for others to tag on to it just what is asked for.

TECUMSEH SWIFT.

A Handy Scratch Gage.

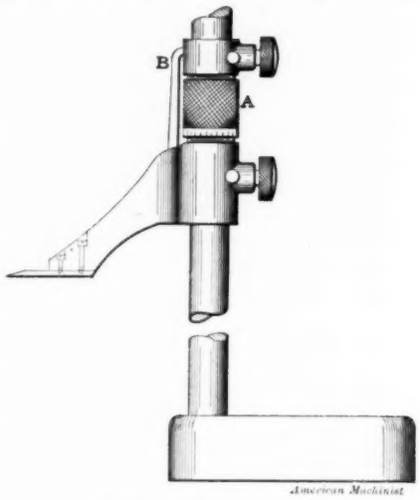
Editor American Machinist:

In the making of templets I found a need for a scratch gage that could be set within a thousandth of an inch, and the sketch shows the tool I made to meet the requirement.

By the aid of this tool, lines can be scribed on a templet at a given hight from the surface plate, and by using an angle plate lines can be placed at right angles to one another, thus giving very often all the principal points from which other lines, arcs and circles must be laid out.

In setting the arm I use inside micrometers for measurements above three inches and inside calipers for shorter measurements.

The nut *A* is threaded at the top to twenty pitch and at the bottom to forty. This gives a movement of 0.025 inch per turn of nut and allows a fine adjustment.



HANDY SCRATCH GAGE.

There is also a coil spring inside the nut to give a positive motion to the arm. The finger *B* prevents the arm turning when adjusting to hight. JOHN KOEHLER.

A Peening Job.

Editor American Machinist:

For the benefit of Mr. Tecumseh Swift I wish to give a little experience of mine in peening. A few years ago I supervised the designing and erection of a 500 horse-power tandem compound engine which had a shaft 13 inches diameter by about 10 or 12 feet long. When we started the engine we found the shaft out what seemed to be ⅛ inch, but which really was 1-16 inch. The shaft was of mild steel and had evidently been forged at too low a heat and probably by too light a hammer. Anyhow, the shaft was in such a condition from strains in it that when the keyway was cut it took out some of the strain on that side and allowed it to collapse, being hollow on the keyway side. The foreman who machined the job thought he knew all about shafting and could not see the necessity of cutting the keyway first and then finish turning.

Well, what to do was the question. We saw there was a good chance for a damage suit if that engine was delayed in getting started, besides a large expense if a new shaft was substituted. After thinking over the matter we decided to try peening, and had the boys strip off the belt wheels and go at it with a sledge. We peened heavily in the bottom of the keyway, also on each side of the keyway, first setting up a heavy jack about under the point that was being

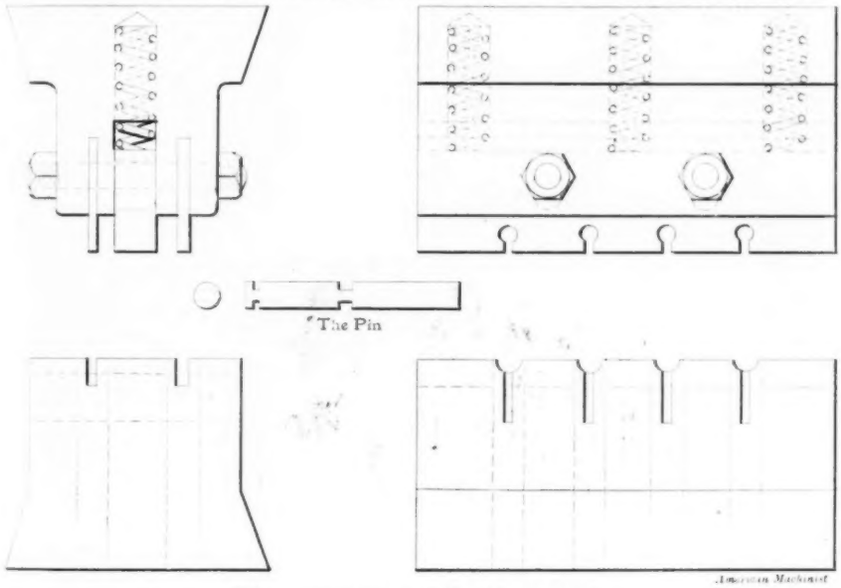
peened. With about a day and a half's work we had that shaft practically straight, leaving it a little overdone. The sides of keyway had to be chipped to get in the keys, which was a small matter.

This may sound very horrible to ground bearing experts, but that engine took the load all right and ran quiet and cool and has continued to do so for about ten years now. Will Mr. Tecumseh Swift tell us what he would have done under the circumstances? J. A. HUTCHINSON.

The Power Press Beats the Milling Machine.

Editor American Machinist:

The power press is the cheapest and most efficient machine tool that can be used for producing duplicate pieces of work within the range of its application. The purpose of writing this is not so much to call attention to the particular subject of the illustration—a comparatively simple operation—as it is to suggest what may be done and thus lead to the consideration of analogous articles capable of being produced in a manner more or less similar that are now perhaps being made on more expensive machines with less economy.



PRESS NOTCHING INSTEAD OF MILLING.

It is rather difficult for the average mechanic to get away from the idea that a power punch press is built for the sole purpose of working up sheet stock, and that it is not applicable to other forms of metal. That it can be made use of for operating on other than flat stock and incidentally effect a saving over common methods, is well indicated by the work done on the pin shown herewith. These pins, which are used in quantities, are made from ¼-inch bright Bessemer rod cut to length by a previous press operation, after which they had formerly been milled by gang cutters in a hand milling machine. Now, one of the requirements was that the cuts should be parallel, a slight variation in the setting resulting in a spoiled pin. The hand milling process proving too slow, a rather elaborate milling fixture was designed, consisting of a cylindrical head to be continuously rotated at a slow rate of speed, and arranged to automatically locate, clamp and release the pins after passing the cutters, the pins being inserted by hand approximately correct. Just how well this carefully thought out scheme might have worked is open to conjecture, for before trying it the bright and proper idea occurred to make use of a press, and since the tools—a punch and die acting on four pins at a time—were completed, no further desire to improve the product, in either quantity or quality, has been expressed or felt.

The tools, as will be seen, are of simple construction, the body of both punch and die being made of annealed steel, fitted as usual to the holders. The die was first slotted in the direction of its length for clearance to the punch blades, then across at right angles, with a milling cutter of the thickness that it was intended the uncut portion of the pins to be, and sufficiently deep to receive appropriate pieces of hardened steel, which shall act as partial supports to the pins and also form one blade of the shear, which the tool practically is.

After this the holes were drilled to let the chips fall through and then the lower shear blades were fitted. While still tight in their places, and soft, another milling cut was taken with a cutter of an eighth of an inch radius, ¼ inch deep, very carefully located so as to be central and in line with the cross slots, thus forming the seats for the pins, after which the die parts were hardened.

The punch was made similarly, except that no cross slots were required and the body was left soft. Other arrangements of stripper plate might have been used, but the springs, of which there are three, are satisfactory; the central part is a free fit, kept from dropping out and guided endways by the bolts passing through the slotted holes in it. Other details of construction, stops, etc., will be evident from the drawing; the shop cost was about eighteen dollars. W.

"Positive Feed Millers," a few Data for "The Note Book of a Cosmopolitan."

Editor American Machinist:

Probably a bit of the history connected with the use of positive feeds on milling machines will prove a valuable addition to the extracts from the "Note Book of a Cosmopolitan," which appeared at page 580. It is easy enough to guess the identity of the makers of milling machines referred to, but it is not so easy to see why they should "be at loggerheads over this very question" when it is well known that both use positive feeds on their millers, the "makers in the East" having first used a combination Renold chain and gear drive (which certainly is positive) on their larger plain millers about three years ago.

The "makers in the West" appeared at the Paris Exposition in 1900 with a universal miller equipped with a feed mechanism that was driven entirely by gears. At that time it was considered somewhat of an innovation to use a positive feed on small universal millers, but there has been a complete reversal of opinion since then and several months ago the "makers in the East" exhibited in their various showrooms throughout the United States a small universal miller equipped with a positive feed. This machine has also been advertised quite extensively in the trade papers.

So much for the history; a few words about construction and utility, although this subject has already been thoroughly threshed over in the advertisements, may appropriately be repeated here.

It is evident that both makers firmly believe in positive feeds since the latest products of their factories are free from friction devices and feed belts and are therefore "positive." These machines can be depended upon to feed the work to the cutter at a uniform rate, that is to say, there will be no change in the relation between the rate of feed chosen and the number of rotations of the cutter, even when working under the severest conditions; and should the size of the cut be beyond the capacity of the machine the driving belt will slip, and therefore, *why should there be any other "slipping point"?*

The fact is, positive feeds are used on millers for the same reason that they are used on lathes—because the users want to force the machines to the utmost capacity of their spindle power and they can't do this when they have to contend with uncertain feed belts.

It is well known that the action of a belt when worked up to its limit is to slip and pick up alternately, which, when applied to feeding a milling machine, gives that

uneven motion to the table which is responsible for the "gouging in" and breaking of cutters. When this happens its repetition is prevented by cutting down the rate of feed which also cuts down the productive capacity of the machine and for that reason such machines cannot take the heavy, fast cuts, nor produce work of so good a quality, nor so much of it, as is gotten out of positive feed millers of the same size. Therein lies the "point about positive feeds for milling machines as understood in the West" and this point is fully appreciated by progressive manufacturers who are finding it profitable to replace the older belt-driven "non-positive" machines and their uncertain output with machines that are positive and can be depended upon for the maximum output.

A VOICE FROM THE WEST.

Turning and Grinding a Large Roll with a Small Lathe.

Editor American Machinist:

A few weeks ago a concern wanted a job done that was too big to go into any lathe in town. It was to turn a roll 40⅜ inches diameter and 8 feet long. The way I did it is pretty well explained in the accompanying photograph. My largest lathe would not swing much more than 36 inches and only about 22 inches over the carriage; further, the roll was upstairs in a factory, and it weighed a good deal more than an 18 in.x10 ft. lathe that I had. I made two castings to fit against the back of the lathe bed, bolting them on so that they would just go inside the frame of the machine at the factory. I took off the headstock, tailstock and legs, and reversed the tool block. Then I took the lathe on a dray to the factory, and put it in the position shown, using a surface gage to get the ends to correspond with the center of the roll.

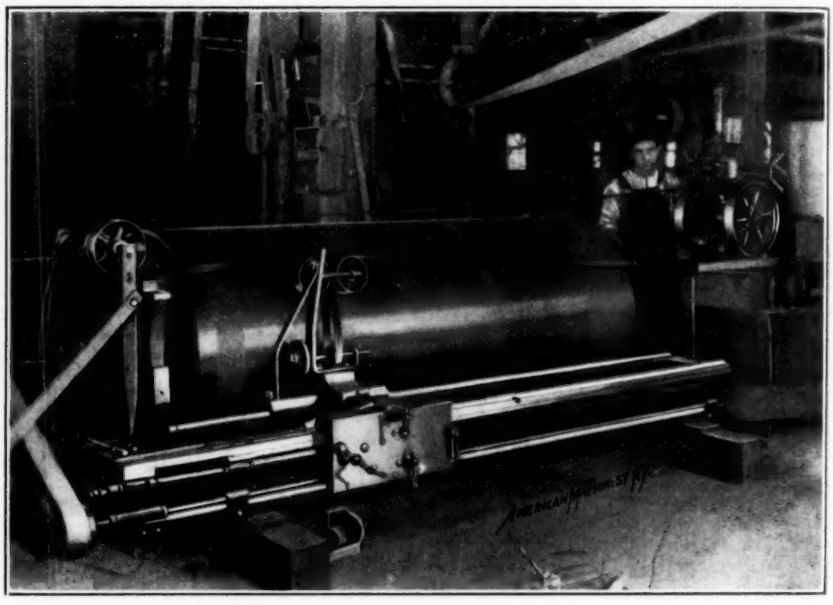
The roll had been turned before and both ends were still of equal diameter, but the middle was worn. After setting the lathe bed parallel, we drilled two bolt holes through the machine frame and castings and bolted everything together, thus making a good solid job. This was very necessary, as there was considerable vibration caused by heavy machinery running close by. The roll was already geared to run very slowly and we obtained a speed of three revolutions per minute without trouble. The feed was easily taken care of by putting a pulley on the discharge pipe of the roll, putting on a dog in such a position that it engaged with the stuffing-box studs. The roll being steam heated, the end of this pipe inside the roll was bent down to nearly touch the bottom in order to keep the water out, the steam being admitted through the opposite end.

We finished the job with the steam turned on, so that the roll should be as nearly as practicable in the same shape and condition as when in use. On account of our allowing the discharge pipe to turn with the roll, the bent end inside was only submerged during a part of the revolution, but this got rid of enough of the condensed steam, so that the roll was hot enough to satisfy us. We extended the pipe through a wall and blew the water and steam outside.

We did a good job of turning, but the concern wanted a smoother finish. Filing was out of the question, as in some parts of the roll the iron was more dense than in others, and we were given to understand that when finished the job must be both round and straight. Grinding seemed to be the only thing to do, so I set about devising a way to do it without going to the expense of making and putting up a long drum to run the emery wheel. I had some gasoline engines in the shop, and I took a 1 horse-power engine, and the photograph explains the rest. By using the belt drive as shown, the belt retained the same tension no matter where the carriage was. The frame for carrying the spindle and idlers was made of a piece of ⅝x2½-inch iron bent as shown. The bearings were made of two 1-inch nipples screwed in and babbitted to the arbor, which was a piece of 13-16 inch cold-rolled steel. While there was no take-up to the bearings I thought they would not wear enough to make any trouble. The result was a job that was very good, considering the vibration referred to. While some of your readers may have seen similar jobs done in similar ways, I never have and I thought that it might prove interesting to many. The wheel might have been driven by a pulley sliding on a splined shaft running two or three feet above the spindle, but it would have required more work and more special stuff made than did the drive adopted, all the pulleys with one exception being picked up round the shop.

CHAS. A. TRASK.

Jackson, Mich.



RIG FOR GRINDING A LARGE STEAM ROLL.

Burning Wet Tan Bark.

Editor American Machinist:

Mr. Osborne's reference to the burning of tan reminded me of a little experience that I had a number of years ago. I was out of my apprenticeship and had been running an engine and firing for a short time, when one day the owner of a tannin extract factory called and said his engineer, who was about to leave him, had recommended me as a first-class engineer and that he must have me at once. I found out later that the reason the man recommended me so highly was that he could not get away until he had supplied a substitute. I concluded to go, and arrived at the factory, which was deep in the woods of Maine, at nightfall after a drive of 40 miles in the middle of winter. In the morning the engineer took me to the factory and showed me around for a short time and then left me to my fate. There were two 40 horse-power boilers with furnaces extending out in front of the boilers 20 feet, making a fire-room 20x20 feet. Each furnace had four holes in the top 15 inches in diameter to fire through. When I arrived, the fire-room was from 4 to 5 feet deep with cold, wet tan. Outside of the building were tons of the same kind that had been thrown away because they could not burn it as fast as it was made. The highest pressure of steam they had been able to get on was 40 pounds, and at times they were bothered for power to run their machinery. My problem was how to burn that wet tan and get on more steam.

I had a theory for firing tan and thought this a good chance to test it. My plan

was to fire one hole, wait 20 minutes, and then fire the next hole, and so on aroun'. I thought this plan would allow the tan under each hole to be quite well burnt up by the time I got around to fire it again. I had trouble at first because some of the covers had been left off and in these holes the tan was feeding itself, which I did not want, but I managed to get the covers on. I found it no easy task to stand on a side hill of wet tan and lift those covers, with sometimes a hundredweight or more of tan on top of them; so, having a rope fall handy, we hung it over the furnace and hooked on to the iron rods connected with the covers; then taking a couple of turns around a line shaft that ran over the furnace we easily raised the covers. The night engineer consented to fire my way, and during the next three weeks we not only burnt all the tan they made but all that had been on the furnace when I arrived. The best of it was that we had 75 pounds of steam, which was quite pleasing to the managers E. J. S.

Gain by Changing a Punching and Forming Operation.

Editor American Machinist:

I will endeavor to illustrate a case of sheet metal stamping and the economy realized by a change in the method of production. The piece, Fig. 6, was to be made of half hard copper ribbon .011 inch thick. About 20,000 were used each week, though 50,000 or so were run out each time the dies were set up. The dies were of the ordinary combination type, as shown in Figs. 1 and 2. It was necessary to form the piece with the concave side down, so the male forming block *A*, Fig. 2, was finished first and fastened to the cast iron plate *F* and the forming head *B* fitted to the block *A*, a formed piece of sheet metal being interposed. The head *B* was left large enough on the outside to finish to the correct shape for blanking. This shape was found by experiment, and the die *C*, Fig. 2, was finished to a templet, the holes were drilled, reamed and tapped, and it was then hardened and tempered. The punches were finished and a tool steel tongue *E* was fastened to the punch *B*, as shown.

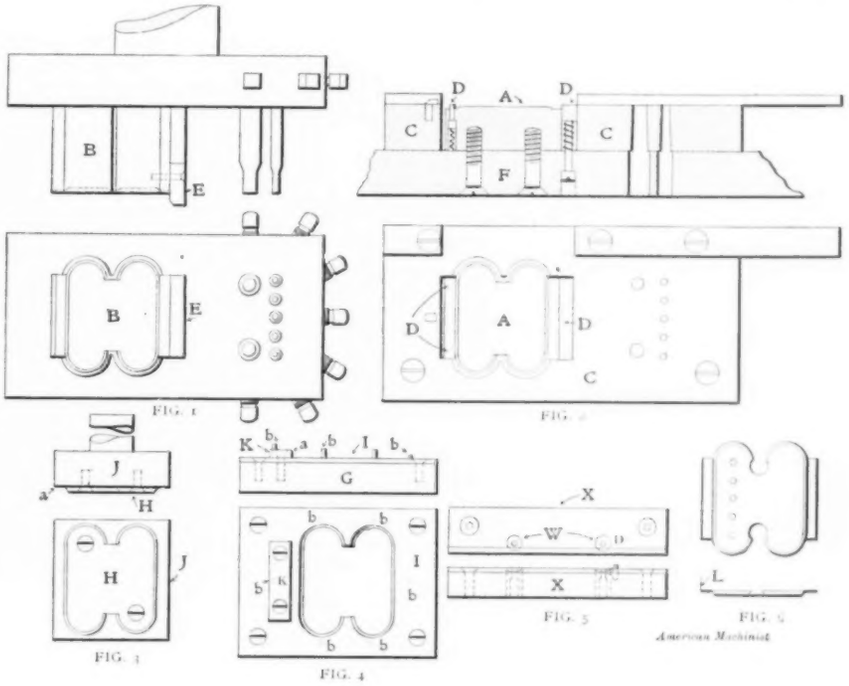
The work of the die for each stroke is as follows: The tongue *E* of the punch strikes the metal first, cutting three edges of the leaf *L*, Fig. 6. Advancing, the leaf is bent, the blank is then cut and the holes for the next piece are punched; the last operation is the forming. The knock-outs *D* remove the piece on the up-stroke and it falls into a box completed, the press being tilted as usual.

Though the work of this die was practically perfect, it "fell down" on the time allowance. Six hundred pieces per hour was all that could be turned out, and it took a steady hand to do that. As there was but one power press on the premises and it was badly needed for other work, we had to make a change somewhere or get another press. An idle foot-press laid out our course, and we decided to blank by power and form by foot; this would at least relieve the power press of its overload. A slight saving was anticipated, but the results were surprising to those interested and were as follows: Saving in cost of labor 15 per cent., in cost of dies 40 per cent., in time on power press 80 per cent.; an idle tool put in commission and another man put to work. The forming time on the foot press was about the same as before, probably a little longer.

The forming tools for the foot press are shown in Figs. 3 and 4, and are made up of two common castings *J* and *G*. The male former *H*, Fig. 3, was made of sheet steel finished to the proper dimensions and fastened by screws to the head *J*. The female former *I*, Fig. 4, was also made of sheet steel, cut out a thickness of metal (.011 inch) larger than the male *H* and screwed to the cast-iron plate *G*. The piece *K*, of steel, was fastened to the die in its proper place; one edge *a* was slightly rounded, as also was the edge *a* of *J*, Fig. 3. These two edges bend the leaf *L*, Fig. 6. Locating pins *b*, Fig. 4, locate the blank properly, and at each stroke a blank is formed hollow side up, just as shown in Fig. 6. The spring of the metal in the leaf *L* exerts just enough pressure on the head to lift the formed blank from the die and hold it until removed by the fingers.

I also append a small kink that saved tool steel and time on repairs. Fig. 5 shows a pair of small piercing dies which were formerly made of ¼x¾-inch tool steel. As the holes had to be close to the edge they broke out pretty often. As shown, the dies *w* were turned from drill rod and driven into the cold-rolled stock *x*. As the grain runs vertically, they lasted longer than a plate. Punches and dies were made in quantities and could be replaced in a few minutes.

I cannot understand why power presses are not driven by stepped cones. When blanking from ribbon or strip and the press is running at 150 revolutions per minute, pieces up to 1½ inches long can be continuously blanked without removing the foot from the treadle; but this speed is too high to do the same thing with pieces 2 inches or longer. If the speed could be reduced a few revolutions, larger work could be continuously blanked in less time than if the treadle was moved once for each piece, and with less fatigue, clatter and pounding of the tripping gear. This seems a small matter, but I am convinced that many hours can be saved by a variable speed device or some such rig. Take, for instance, the job just mentioned. The press runs at 145 revolutions per minute, and 2,900 pieces can be blanked per hour. This shows a loss of almost 200 revolutions per minute. If the speed was reduced one-third, almost twice as much work could be turned out in a unit of time, because a piece would be made for each revolution of the press, and this might run up to 6,000 pieces per hour without any serious inconvenience to the operator. WM. H. BROOKS.



TWO PUNCHES AND DIES FOR THE SAME OPERATION.

The Stepped Stocking Cutter.

Editor American Machinist:

At page 423 of your esteemed paper I have read with great interest the article headed "Some New Things," which also gives a description of a stepped stocking cutter as made by Gould & Eberhardt, of

Newark, N. J. This style of cutter has indeed all the advantages stated. As I have been a designer in Mr. Reinecker's shop for some years, I beg to say that, recognizing the merits of the said tool, we have manufactured it here for the past six years.

Enclosed please find some photographs showing the stepped cutters in combination with rack cutters as used in Reinecker's patent rack cutting machine, of which a great many are sold, and all of them are fitted with this style of stocking cutters.

I doubt not that Mr. Eberhardt, of the firm mentioned above, whom I had the pleasure of showing our works last year, will have noticed that we have a large number of these cutters in use ourselves. Also all outside orders in stocking cutters for gear teeth we execute in this way, unless otherwise ordered. Six years ago we supplied the firm of Janssen, of Paris, with the first set, but as we considered this improvement a small item in modern tool construction we took no occasion to draw special attention to this new feature.

HEINRICH MEYER.

Chemnitz, Germany.

[There is no need to reproduce the photographs which Mr. Meyer incloses; they show all he claims. In such minor matters as these the AMERICAN MACHINIST must perforce depend more or less upon the statements of those who submit such matter for publication. Though we keep fairly well informed in matters of gearing cutting we cannot of course be so minutely informed as those who are in the business and are specialists in it. The cutter referred to was submitted to us by Gould & Eberhardt as something new, and the man who handled it, not having happened to have seen such cutters before, was justified in accepting their statement. The communication of Messrs. Brown & Sharpe (at page 561) showed, however, that it had been in use for at least ten years, and the foregoing that it has been known in Germany for at least six years. —Ed.]

How to Show a Shop.

Editor American Machinist:

Some time ago I read an article in the AMERICAN MACHINIST in which it was implied that some kind of hypnotic influence held sway over some or all of the members of the American Society of Mechanical Engineers at one of their New York meetings. If it were possible to have the chief hypnotist visit our section and exert his influence on some of our shop owners and get them so under his control that he could persuade them that it would be greatly to their advantage to make a substantial raise in salaries, I would not be slow in guaranteeing him his car fares and something toward paying his board and time. I would hardly care to agree to pay his time in full, for a man who could hypnotize even a few members of the American Society of Mechanical Engineers no doubt sets a high price on his time. Unfortunately, I am not a member and don't know the least thing about the qualifications necessary. But it must be a fine thing to be a member and to visit different parts of the country on the annual trips, seeing the sights, no doubt learning something from every trip, and perchance teaching much to those fortunates with whom they come in contact. The only time I had the pleasure of meeting the members in a body was on the occasion of their holding their meeting in our town. They arrived by special train (all parlor cars) bringing with them quite a number of ladies. They were met at the depot by a committee of resident members, also the mayor and a lot of city officials who escorted them to the best hotel in the town. What they did at their meetings I had no means of knowing except as I read in the reports published, but I do know considerable about what they saw and did *not* see while visiting the different manufacturing establishments of our town. We had a new plant, one that was supposed to be up to date. Our manager was a M. E., and, consequently, had to spend much of his time with the visitors. Some three or four of us understrappers were detailed by him to see that the works were in proper shape to undergo the inspection of the distinguished visitors. He called us together and laid down his plans. He was going to give them a reception that would make them glad to be there. The principal feature of this reception was to consist of a lunch in the drafting room and offices, a lunch both wet and dry, after which a tour of the plant would be made. One of us ventured to suggest that it would be better to make the tour of inspection first: less walking and talking might be required. But our manager would not have it that way, so the lunch came first. He gave special directions in regard to what he wished them to see and what he did not wish them to see, for although our plant was fully up to date we had to admit there were some things we did not care to show —for instance, the foundry yard and the pattern storehouse. We all know that usually these two places are about the most disorderly parts of a manufacturing plant. Also, if possible, we were to steer them clear of the old 20-foot boring and turning mill and several other tools that did not compare favorably with the rest of the plant. It was suggested that it might be difficult to keep clear of the boring mill, as it occupied a very prominent place in the shop, and in the direct line of travel from the drafting room through the machine shop. It was decided that if the squad leaders could not steer clear of the objectionable tools and places, each was to make the best explanation he could as to why a modern plant still held on to out-of-date tools and did not have every part of the plant in the best of order. He was particularly anxious to have them all see the hydraulic boiler head flanging machine and to see it in full operation. We tried to explain that the thing was new and the men green in handling it. We were having trouble in operating it. Would it not be better to have them see it when not in operation? It looked all right then. Our suggestions were of no avail; so the route was laid out and he left us to prepare for the visitors.

From the office windows we could see the long line of carriages approaching. They looked for all the world like a funeral procession. But the speed at which they came was not funereal. Being somewhat younger and perhaps more verdant then than now, I was prepared to receive men not only distinguished but looking so, and was quite disappointed to find them looking much as any lot of ordinary everyday machinists might look under the same circumstances. And the justice they did to the lunch (which was excellent) indicated that their enjoyment of such things was much the same as it is to some of us who are not supposed to be up in the high C's. After lunch the party was divided into squads of about a dozen each, and a start was made. The first thing we came up against that I thought needed an apology was an old pit lathe, and I am sure if I had the thing to do now I would make no apology for it, but instead would explain that for the purpose it was the only kind of a machine to use. It required considerable maneuvering to keep those fellows from wandering into forbidden paths, and in spite of our efforts they all pulled up in front of the 20-foot boring mill. Some of them did not recognize the machine as a boring mill. It was not boring at the time, but turning a pulley about 15 feet in diameter, and doing it in a way that perhaps was a revelation to our visitors. It seemed as if the hub of the pulley was all the time getting ahead of the rim, which made it necessary for the rim to jump a couple of feet every now and then in order to catch up. I explained that owing to the crowded condition of the heavy tool shops we had not yet received our new mill. (It was not ordered at the time. It takes money to buy 20-foot boring mills.) Someone asked where the machine was built. I could not tell, as it was old and never had a name plate on it. (In fact, it was home made.) One gentleman remarked he would like very much to have a photograph of it. I think a picture taken by a "moving picture" instrument would have been the only thing that could have shown it to perfection. Finally, they got through with its examination and we passed on to the foundry. It was necessary to pass through the foundry yard. As this was forbidden ground, I suggested that it would be well to step lively as the drop for breaking scrap was in operation and the neighborhood not particularly

safe. Next we went to the boiler shop and the head flanging shop. Here everything was lively. A furnace full of heads was all ready to be operated upon. The machine had been giving trouble all along by the heads shrinking on to the plunger and coming out of the die. That is just what happened to the first head flanged, and it was still on the plunger when we left the department. We decided that the best thing to do was to get the crowd back to the lunch room and give them a chance at the good things again, and in that way help them to forget the flanging machine. Finally, we saw them all loaded in their carriages and on their way to another prominent establishment.

I have often wondered what the members learned from their inspection of our plant. We all knew well that we learned nothing from them, for they were as close as clams, and seemed averse to imparting useful information. B. W. T.

Long Distance Steam Heating Plant.

Consul-General Richard Guenther writes from Frankfort of the completion of the largest long-distance steam-heating plant in Europe. He says: "From a central station many public buildings on the left bank of the River Elbe, including the theater, the museum, the castle, the royal kitchen the custom-house, etc., are heated. The greatest distance over which heat is transmitted is three-fourths of a mile. The total heat consumption per hour is 15,200,000 heat units. The usual steam pressure is two atmospheres. Ten of the fourteen boilers are used, and, to guard against accidents, two main lines of pipes have been provided. The loss of heat in transmission is from 4 to 4½ per cent. The pipes are protected by two layers of tin, the inner layer being perforated and the outer one covered with silk. The largest pipes have a diameter of 216 millimeters (8.51 inches)."

This loss of heat in transmission is astoni-shingly low. The style of pipe covering is probably incorrectly or incompletely described.

The Nine-Hour Day for Machinists.

THE SITUATION IN WORCESTER.

There is no material change in the situation since last week. So far as can be learned, none of the blank agreements sent to employers has yet elicited any response, and it is understood that though there is a considerable proportion of the employers that believe in a shorter day, there is an agreement not to "recognize" the union, as the feeling is that no one can tell what that might lead to. Nearly all the employers have joined the Metal Trades Association. A number of concerns have signified their willingness to confer with a committee of their employees in that capacity only, but the men contend that conferences should be with union officials only, since the I. A. M. has charge of the movement. In one case the union men, who compose about one third of the force of 100 men, did meet and discuss with the proprietor shorter hours and increased wages, but with no definite result, so far as we can learn.

The men seem to have no particular grievance, except that they think the employers are getting more than their share of the present prosperity. An employer who expresses his belief that the apparently inevitable strike will end disastrously for the men declared himself to be, nevertheless in sympathy with their desire to improve their condition, if such improvement can be brought about in proper ways. He said: "I think the trusts are in a great measure to blame for the present state of things. When a workman by working 300 days in a year can earn but seven or eight hundred dollars, he naturally wonders where he is 'at' when he reads of another man, an ex-workman, who apparently spends most of his time attending banquets and draws a salary in the neighborhood of a million. It seems to me that the workman might logically ask if a part of that million does not belong to him in the form of shorter hours of labor and possibly another dollar per week in his envelope."

But the man who expresses himself thus does not believe that the remedy for this state of affairs is for proprietors to place the management of their shops in the hands of employees or of officials representing them.

IN CHICAGO.

No change in the situation is reported from Chicago, each side seeming to be simply waiting for the other to make a move, though if any decided action is taken it is expected to be taken by the men, the proprietors being generally agreed that there is nothing for them to do until circumstances call for some action.

From Cleveland, Ohio, comes the report of a strike of metal polishers in several establishments there, the men demanding and the employers refusing a nine-hour working day. It is reported that several large concerns have granted the demand of the men and their establishments are running.

Second-Class Mail Privileges and Humbugs.

By a recent decision of the Supreme Court of the District of Columbia the Railway Equipment and Publication Company gained a victory over the postal authorities. The publication company named have been issuing for some time what is known as the "Pocket List of Railroad Officials." The Post Office authorities took away from this publication the privilege of the second-rate classification and the publishers appealed to the courts with the result that they have come out victorious.

There is a growing feeling that notwithstanding the fact that abuses exist that should be corrected it is unwise that such autocratic power should be vested in one man as has been exercised in recent postal decisions. As matters now stand, a single official in the Post Office Department has it within his power to ruin the business of a concern depending upon the use of the mails and an individual may find that not only is the law interpreted but that he may be convicted of having violated that law without a trial of the case in the regular form as would seem to be provided by the Constitution. The recent case of a man who applied the endless-chain principle to the sale of a fountain pen illustrates. He got his endless-chain moving in some way and had received such quantities of mail in the small town in which he lived that the postal authorities began to suspect there must be some fraud about it and, *pending an investigation*, withheld his mail, thereby of course ruining his business. It would seem that the investigation should at least precede action calculated to ruin a man's business.

In the meantime the swindlers of Cleveland, Ohio, who offer small shipments of oil "near you" at reduced rates go merrily on, regardless of the fact that their fraudulent use of the mails has been repeatedly brought to the attention of the postal authorities. Neither have we heard of the exclusion from the "second class" mail privileges of the *Southern Review of Commerce* and other papers of that ilk, though they are palpable and arrant frauds.

Municipal Civil Service Commission.

An examination for the position of Civil Service Examiner, Mechanical Engineer, is to be held at 346 Broadway, New York city, June 2, 1902. The subjects in the examination are technical knowledge, experience and mathematics. For further information aupply to F. G. Ireland, Chief Examiner, and for application blanks address George McAneny, secretary.

A meeting of the National Foundrymen's Association, Philadelphia branch, was held May 8 at the Manufacturers' Club. An interesting description by Mr. Mumford of the recent forms of Tabor vibratory molding machines was preceded by a prophetical talk by Mr. Outerbridge, of Wm. Sellers & Co., who said that he did not see why the molding machine should not eventually be used in casting large pieces, such as engine beds, etc., if the same ratio of progress were made in the next few years as of late. After supper followed an interesting discussion on the relation of employer to employed in the foundry business.

The full name and address of the sender should *always* be plainly written upon every manuscript, drawing or photograph sent to the editor. There is no exception to this, and it is not sufficient to write it upon the envelope or separately in a letter.

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Good Enough.

In *The Engineer* (London) for March 14 we find an editorial under the above title, the temper of which is sufficiently shown by the following extracts:

"However, all that is to be changed, and we are to enter upon a policy of which 'good enough' will be the watchword. It is not altogether pleasant to have to admit that the 'thorough' days are dead or dying. There is something exceedingly fascinating about the idea that every part of a machine is superlatively good; something almost of the divine in the thought that the hidden parts are not less beautiful in their design and workmanship than the parts seen; something inexpressibly satisfying in the knowledge that no human thought or skill could make it more perfect in every respect, even to the smallest screw or pin. It is not within our capacity to describe the emotion which is felt when one regards anything so excellent, and it is the less necessary because every engineer worthy of the name has felt it for himself. It is not pleasant, we repeat, to feel that that magnificent ideal is doomed. And yet we are not without some consolation. Though we lose the superlatively excellent, we are left with a substitute cheaper, more accessible to the many, and good enough for the purpose to which it is to be put."

The wicked Americans are held responsible for the forced discarding of high ideals by the British in the following words:

"The Americans, with no such traditions behind them as have our manufacturers, have given up following the windings of a circuitous road, and made straight across country to a point which all we Western nations will ultimately reach. They have made 'Good enough' their motto. It is written in locomotives whose life is short, in machine tools unable to bear an overload, in harvesting machinery appallingly cheap and roughly made, but sufficient for its work, in the thousand-and-one jimcrack odds and ends with which everyone is acquainted. They have invaded our markets with the same ware, and undersold us, because, whilst ours were thoroughly good, theirs were only good enough; and they come into our midst, bringing the same principles with them. What internal competition was doing gradually their competition will bring about rapidly."

Thus, according to *The Engineer*, we are leaders in a bad cause, demoralizers of the virtuous who are reluctantly compelled by the forces of competition to follow our example.

We do not propose to institute any defense of American workmanship or to urge that it is, on the whole, equal to or better than that done in Great Britain. There is, in fact, no doubt that in many lines of work British workmanship is better than American, and there is just as little doubt that in others ours is better than theirs.

What amuses us in our contemporary's editorial is the assumption that commercial machinery has ever been made anywhere or by anybody in accordance with any other rule than that of "good enough." There are a few examples of mechanical construction to be found in the making of which the only rule followed was to make the essential parts as good as they could be made, and when done to regret that they were not still better. Scientific laboratories, and especially astronomical observatories, contain many examples of this class of workmanship. Scientific apparatus is not, however, commercial machinery, and machinery made in this spirit is a rare thing in machine shops. Examples of this class of commercial workmanship may be found in measuring machines and standard gages. Precision bench lathes and other tools of that class come very near, and perhaps quite up, to this standard, and there, so far as we can recall, the list stops. Practically all other commercial mechanical products are made to be good enough, and this is as true of the best as of the poorest and of their primary and secondary parts alike.

Is there, or has there ever been, a lathe maker in Great Britain who devotes the same care to the cross-feed screws of his lathes that he does to their lead screws? Is there one who devotes the attention to the fit of the legs to the lower side of the shears that he does to that of the headstock to the upper side? Is there one who makes the bolts that secure the headstock to the shears as a micrometer caliper maker makes the screws of his calipers? Is there an English engine builder who alines his engine shafts as lathe builders do their live spindles? The questions appear to be absurd, but in view of the remarkable editorial of our contemporary they are not. The absurdity lies in the statements quoted above, the gem of which perhaps is that there is "something inexpressibly satisfying in the knowledge that no human thought or skill could make it more perfect in every respect, even to the smallest screw or pin." English and American lathe makers alike plane the joints between legs and shears, while they scrape those between the headstock and shears because for the former purpose a planed joint is good enough; they put a high grade of workmanship on the lead screw and a lower grade on the cross-feed screw because for its purpose the lower grade is good enough; and they cut their binding bolts on a bolt cutter because for such purposes die-cut threads are good enough. Lathe spindles must be accurately alined in order to do satisfactory work, while engine shafts will do satisfactory work if less accurately alined, and in both cases the only aim is to make the work good enough. In all the pieces of work cited the workmanship is only up to the stand-

ard of good enough. No lead screw or micrometer caliper screw is as accurate as "human skill could make it," and, indeed, in comparison with the precision screws of measuring machines or dividing engines, both are highly inaccurate.

No other standard than that of good enough is, or ever has been, possible in the general run of machine work. The difference between the products of different establishments is simply due to a difference of judgment as to what is good enough, and the better the product the more certain is the maker to recognize the fact. Many a man who never saw a scraped surface thinks that work done on a planing machine is "flat," while the man of the highest mechanical ideals and accomplishments invariably recognizes the limitations of workmanship, the gap between the possible and the perfect and the still wider gap between the commercially feasible and the mechanically possible.

The idea that good enough workmanship is incompatible with thorough workmanship is absurd. For some purposes only the best possible is good enough and for others nothing that is possible is good enough. It is in deciding what is good enough that the highest mechanical judgment is required and with the people that decide this wisely will reside the mechanical supremacy of the future.

Henry Morton.

Henry Morton, Sc.D., LL.D., organizer and president of Stevens Institute of Technology, Hoboken, N. J., died at a private hospital in New York, May 9, a few days after an operation for calculus. His death removes one of the most versatile and brilliant of men from American science. He may fitly be characterized as an *ornament* to the engineering profession, not meaning thereby to disparage his usefulness, but to emphasize the fact that he bore to a conspicuous place in the mechanical field that breadth of culture and grace of personality of which, as is perhaps inevitable, modern technical training is producing fewer examples than are found in some other pursuits. The influence, moreover, that he exerted upon engineering practice through the school whose policy he shaped for about thirty years was greater than can easily be estimated.

In the year 1869 the will of Edwin A. Stevens placed at disposal an endowment for an "institution of learning." Just what sort of learning was to be taught at this institution Mr. Stevens did not specify, and the decision fell chiefly upon S. Bayard Dod, who is still president of the board of trustees of Stevens Institute. Mr. Dod took counsel of Dr. McCosh, of Princeton, who advised him to make it a second Rugby, but that advice failed to suit, and—no doubt prompted by the engineering history of the Stevens family—it was decided to start a school of technical science. In Philadelphia Mr. Dod found a young man, Henry Morton, Ph.D., at that time the life of the Franklin Institue, and to him the execution of the plan was entrusted.

Henry Morton, the son of an Episcopal clergyman, was born December 11, 1836. He entered the University of Pennsylvania as a sophomore and was graduated in 1857, after which he gave much of his attention to painting, drawing and languages. About this time he worked out the first complete translation of the hieroglyphs of the Rosetta stone, which, having been published in a book with numerous colored illustrations, was characterized by Baron Alexander Von Humboldt as "the first essay at independent investigation by the literature of the new continent." Morton read law for a while in the office of George M. Wharton, Philadelphia, but soon turned himself to the study of chemistry, physics and mechanics. About this time he was engaged by the Episcopal Academy of Philadelphia, to give instruction in chemistry and physics. Most of the apparatus used was made by himself and soon his lecture room became famous in the city. In 1863 he became professor of Chemistry in the Philadelphia Dental College, and the next year resident secretary of the Franklin Institute. It was to aid the latter that he began to deliver in the Academy of Music, Philadelphia, a series of lectures on Light, Heat, Sound, etc., which proved brilliantly successful. In 1868, he accepted temporarily the chair of chemistry and physics at the University of Pennsylvania, and later a new chair of chemistry was created for him. In connection with some observations of a total eclipse of the sun made in Iowa by an expedition of the United States Nautical Almanac Office, Dr. Morton was the first to prove the true nature of the bright line on the sun's disk adjacent to the edge of the moon, which is seen in partial eclipse photographs.

The new school organized by Dr. Morton in Hoboken was the first in the country to teach the mechanical engineering profession exclusively. He brought with him an able corps of assistants of whom he has survived several and of whom those that survive him are now all elderly men. One of them, typical of the old-school professorate, and now deceased, was Dr. Alfred M. Mayer, an associate of Dr. Morton's earlier in his career and an eminent physicist. Originally the curriculum verged more to pure science than it does now, the practical shop features being a matter of development aided by the reactive influence of the graduates who went out into the world. In fact the relations—other than of a sentimental sort—between the college and its alumni have always been so close as to affect materially the history of the former. Since its early years the institution has, almost without exception, recruited its instructors and professors from its own graduates. Whether this policy will now be applied in the choice of a president it is rather early to discuss, but it need occasion no surprise if such proves to be the case.

It is largely to the credit of Dr. Morton's executive ability that a dozen or more years ago his college, with apparent justice, enjoyed the reputation of being the most thorough school of mechanical engineering, if not of engineering of any sort, to be found in the country. What was accomplished was done, too, with narrow financial means. Whether any of the newer and more heavily endowed schools have since then outstripped it in character of instruction, we cannot say, but at all events it still holds a place well toward the front. A considerable portion of the present equipment of the college is the personal gift of Dr. Morton, whose donations during his life have amounted to $145,000. He has been enabled to make these bestowals largely through the proceeds of a lucrative business as patent expert, in which avocation there is perhaps no other man in the country more eminent than he. Of late, moreover, he has shown his tact for provoking outside benevolence, which in these days is said to be the chief qualification of a college president.

Both as an original investigator and as a critic Dr. Morton has often been before the scientific public. One of his most important researches was that on "Fluorescence and the Absorption Spectra of Uranium Salts"; another was upon water gas. He was the discoverer of Thallene, a fluorescent substance. He made the first thorough investigation of Edison's incandescent lamp. Among his contributions to the periodical press and most characteristic of his mental acumen were his recent expositions of "Mechanical Fallacies." He was associated with such men as Prof. Stokes, of Cambridge, England, and Prof. Tyndall. In 1873 he was elected to the National Academy. In 1878 he was appointed to the United States Lighthouse Board to fill the vacancy caused by the death of Prof. Joseph Henry. Among the degrees he received are: Ph.D., Dickinson College, 1869; Ph.D., Princeton, 1870; Sc.D., University of Pennsylvania, 1897; LL.D., Princeton, 1897.

His many-sidedness was greater even than appears from what has already been said. He was an ardent theologian and writer in that province, one of his points being the acceptance of modern Higher Criticism as consistent with religion, and another being the contention that science can neither prove nor disprove religious truths. Moreover, he gave occasional rein to poetic inclination, and verse from his pen many times found its way into leading American magazines. Another manifestation of this exceptional side of Dr. Morton's nature was the delight he took in devising the supper-table equipment, symbolical of iron working, at the Carnegie Laboratory dedication last winter. On

the same order was the dinner given by him to the members of an expedition sent out to dig up old jars in Ur of the Chaldees and whom he enabled, as a preliminary practice, to excavate souvenir vases from a model confectionery ruin.

But President Morton's personality, as his students and alumni generally knew it, was of the kind that appeals strongly to those who can judge with the intellect and the taste, rather than with the emotions. His was not the "magnetism" which invites confidences, but the keenness, polish and poise which excite admiration at a little distance. His lectures, even if not fully appreciated by his student hearers at the time, can be looked back to with delight, while on his brief reappearances at alumni meetings his words were able to inspire something akin to high enthusiasm. His style was that of elegant colloquialism bristling with allusions drawn from a wide experience and with well-turned phrases which sometimes were sharper than any two-edged sword. Within the scope of his lectures—physics and electricity—he laid stress on the necessity of understanding rather than of memorizing, and he assumed a most apologetic tone when asking that some simple fundamental formula be learned by rote. He himself had a peculiar deficiency in mental retentiveness of the parrot-like type, as illustrated by a difficulty with orthography which he experienced to the end of his days and which to a man whose reputation for culture was less secure might have caused some embarrassment. That he did not expect others to remember where he himself would not have wanted to try to do so, was evidential of his fairness.

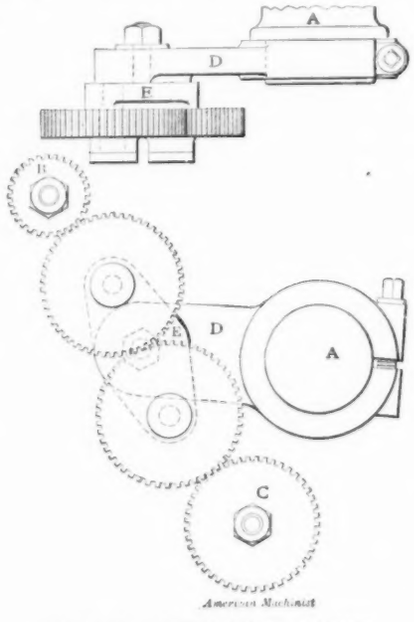
President Morton was not given to formulating codes of rules for the walk and conduct of his students. He viewed the college as a professional school and did not care to employ the "paternal" system of government. When, however, occasion required he could act decisively. An instance of this occurred when the student publishers of the college annual, in order to make up a financial shortage, posted a lottery advertisement in the vestibule. President Morton ordered it taken down with the remark that lotteries might be all right at church fairs, but that they certainly would not be allowed in Stevens Institute.

It seems that a member of a prominent music publishing house in Chicago attempted to dictate to the paper known as *The Music Trades* regarding a piece of news which had been sent in by that journal's correspondent. The music dealer informed the editor that he demanded that this news should not be published, and that in making such demand he represented a number of prominent concerns, some or all of whom were advertisers in the journal named. The reply received by the prominent publisher from the editor of *The Music Trades*, Mr. John C. Freund, was no doubt very illuminating to the aforesaid music publisher. He was, in effect, told that as it was his business to public music, so it was the editor's business to publish the news, and that the news was going to be published since it was obtained in a legitimate way and was news that it was perfectly proper in every way to publish—and the news was published, the details of how it was published, and why, being given in the issue of the journal referred to under date of May 3, which might make very interesting reading for some of our friends who are in the habit of being dissatisfied when they find that the AMERICAN MACHINIST has in some way done something which they think ought to have been done differently or not done at all.

Some New Things.

IMPROVED INTERMEDIATE GEARING.

The cut shows, in a way that explains itself, an improved arrangement of intermediate gearing for a screw cutting lathe recently patented by F. W. Gordon and assigned to the Pratt & Whitney Company. The device takes the place of the single large gear and the slotted quadrant so generally used. The stud *A* is permanently located as indicated with reference to the spindle gear *B* and the screw gear *C*. On the stud *A* is mounted the arm *D* with the split hub, which allows it to be clamped in any position. On the outer end of *D* is the double-armed piece *E* carrying a loose gear on each arm, the two meshing together. When the gears on either or both the spindle and screw are changed the intermediates may be easily made to connect properly by turning piece *E* and moving arm *D* and clamping them in position. It may be thought that the location of *A* has to be accurately determined, but this is not so, as it may be located anywhere in the neighborhood and the gears will still connect up to the aggregate of the two diameters.



IMPROVED INTERMEDIATE GEARING.

From Pottstown, Pa., comes the news that United Mine Workers have engaged counsel in Philadelphia, New York and elsewhere to take such action as will lead to some investigation of the pooling of anthracite railroads, by which four railroads practically own and control the anthracite coal business of the country. The miners propose also to secure a more equitable assessment for taxation of lands belonging to these companies, the claim being made that unused coal lands are assessed at figures so much below their real value as to be absurd, the assessors thus assisting the companies in the maintenance of their monopolies. These undoubtedly are vulnerable points, and the United Mine Workers may do the public a service if they bring these things to light and cause a rectification of them.

Purdue University has now in process of erection a temporary building for the accommodation of its collection of historic locomotives. The building is 60x64 feet and contains four tracks, three of which are already occupied by locomotives. The list includes the "James Tolman," an engine of English design; the B. & O. engine No. 173, known as a Hayes ten-wheel "camel," and a 16x24-inch American-type engine from the Chicago & Northwestern Railroad. We understand that the university very much desires to obtain an inside-connected engine which it can add to its collection.

An idea of the extent to which variable speed transmissions are now being used is derivable from a photograph we have recently received showing on the floor of the Reeves Pulley Company's shop at Columbus, Ind., six large transmissions ordered by the Niles Tool Works, of Hamilton, for use in connection with tools shipped to the British Westinghouse Company. These transmissions are somewhat new in design, the frames being U-shaped and calculated to secure the greatest possible rigidity. It seems to be more and more evident that the days of the stepped pulley are numbered.

The meeting of the American Foundrymen's Association begins in Boston, June 17. The secretary, Richard Moldenke, Box 432, New York, announces that the usual arrangements have been made with the transportation lines whereby members and visitors can make the round trip from any point for a fare and one-third. Tickets under this arrangement may be bought not earlier than June 13, and will be good until June 23. Detailed information will be furnished by the secretary.

It is reported that the Northern of France Railway is building an express engine of the Atlantic type with a water-tube boiler.

Personal.

William E. Reed, of the Warner & Swasey Company, Cleveland, was married on the 25th ult. to Miss Emma Louise Du Puy, of Erie, Pa.

Edward C. De Wolfe, late in charge of the drafting room of the Dodge Manufacturing Company, of Mishawaka, Ind., and a contributor to the columns of various mechanical journals, has become associate editor of *Steam Engineering*.

Prof. C. V. Kerr has resigned his position as professor of mechanical engineering in the Armour Institute of Technology, Chicago, with the intention of going into engineering practice along the line of power plant and shop engineering.

Herbert L. Towle, who is conducting an office for drafting and machine design, making a specialty of gas engine and automobile work, has removed from 123 Liberty street, New York, to larger quarters at 116 Nassau street, room 1103. He has enlarged his staff by the addition of Harry G. Wakeman, lately with the Upton Machine Company and formerly with the Daimler Manufacturing Company.

Obituary.

Benjamin Arnold died at East Greenwich, R. I., May 5, eighty years old. Mr. Arnold was an inventor in the textile industries. His most successful inventions were for machines for making seines. The patent for the first machine was sold to a Baltimore firm in 1864 and he soon devised another which entirely avoided the claims of the first patent. After buying five or six successive patents the firm finally made a contract covering all subsequent inventions in that line. Mr. Arnold also invented a knitting machine for shawls, braiding machines, carding machines, and others in the same line.

Joseph B. Renshaw died in Hartford, Conn., May 4, eighty years old. He came to this country from England at the age of 25 and was for some years master mechanic of the shops at Michigan City of the Michigan Central Railroad. He first engaged with Pratt & Whitney about thirty years ago and devised the Renshaw ratchet drill made by the company. Mr. Renshaw later removed to Cleveland in the service of Warner & Swasey. He was an inventor in numerous fields. He devised a centrifugal skimming gate which has been valuable in the foundry, a system of doweling wood or metal patterns and other foundry inventions which were manufactured by the Foundry Supply Company. Among other inventions are a draftsman's dividers, a micrometer depth gage, a staybolt cutter.

Commercial Review.

NEW YORK, Monday, May 12, 1902.

VARIOUS MARKET NOTES.

Labor troubles this spring have caused few irregularities in the pulse of the machinery trade. One of the symptoms which may be detected more as a matter of curiosity than anything else is a slacking of business in the anthracite coal region noticed at the agency of a prominent house manufacturing machinists' small tools and selling them to the jobbing and retail trade. Business as a whole was by the same concern pronounced highly satisfactory, albeit not quite so heavy as it has been earlier in the season. In different lines of trade there seems to be an increasing amount of indication that the hight of the season is passed and that summer is approaching. A prominent engine building concern, however, reports a greater rather than a less inquiry than for some time past in electrical lines, this being logically attributable to preparations for fall installation, a source of demand which sometimes keeps engine sellers busy while those in various other branches of the machinery market are lapsing into their annual period of idleness.

The new shops of the Philadelphia Pneumatic Tool Company at Twenty-first street and Allegheny avenue, Philadelphia, are nearing completion and the company expects to remove to them the last week in this month. The power plant is now installed and everything will be in readiness for the full operation of the new plant in the course of two weeks. There have been ordered about $10,000 worth of new machine tools to be delivered early in June, and with these the company will soon be able to relieve its much overcrowded condition and make prompt deliveries. About 150 men will be required immediately to do the work which the company is at present trying to do in its crowded quarters with 95. It has recently placed upon the market two new sizes of rotary drills and has perfected an improved riveting hammer which is being made in three sizes, having capacities varying from ¼ to 1¼-inch rivets. It has recently received orders aggregating nearly two hundred tools from one of the largest shipyards in the country, and this, together with a lot of railroad and other trade, makes an unprecedented rush of business. It is making preparations for an elaborate display of tools in a working exhibit at the convention of master mechanics and master car builders at Saratoga, June 18 to 25.

Business of the Chicago Pneumatic Tool Company is reported "never better." The company has lately added thirty men at the Franklin (Pa.) works, and is putting more on and is expecting soon to work nights. It has been putting in additional tools, such as planers, drills and lathes. The company has been awarded the contracts for three large air compressors for the Philadelphia & Reading Railroad, two compound air compressors of 2,000 cubic feet capacity for the new car shops of the New York, New Haven & Hartford Railroad at Readville, Mass., and one for the Atchison, Topeka & Santa Fé. One order from Germany recently called for 167 tools.

An active and steady demand for products of the Buffalo Forge Company, of Buffalo, N. Y., is reported. Among many contracts recently booked is the equipment of the Pennsylvania Steel Company's forge shop at Philadelphia with twenty Buffalo down draft forges. Three large Buffalo Fan System heating plants will be installed for the Lake Shore & Michigan Southern railroad shops, of Collinwood, Ohio. The Bowery Bay Building and Improvement Company, New York city, has ordered a 200 horse-power horizontal center-crank engine for electric lighting. The Buffalo Forge Company is also to furnish the Seaboard Realty Company, of New York city, with six 120 horse-power engines and two 95 horse-power engines for electric-lighting purposes.

The imports of machinery from the United States into China for 1901 are estimated by Consul-General Goodnow at 200,000 Haikwan taels ($144,000), against 450,000 Haikwan taels ($357,500) for 1900. It must be remembered, moreover, that the year 1900 was that of the war, though it is true that that did not come until about the middle of the year and to its lingering effects might be attributed a falling off of imports in 1901. Yet the general trade of China recovered rapidly from the depression of 1900, so that the total net imports of the country for 1901 exceeded not only those of 1900 but of 1899, while the exports for 1901, although considerably under the figures for 1899, were in excess of those for 1900.

The General Electric Company's works are like woman's work—never done. Not only is the company a steady purchaser in the tool market for renewals and additions to equipment, but there is almost always some new building in project. The latest extension reported is a 300-foot addition which the company contemplates building to shop No. 29 at Schenectady, making it 800x100 feet.

The Warren Steam Pump Company, Worcester, Mass., has placed contracts for machinery which will be installed in a machine shop addition that the company is about to build.

A 2,000 horse-power Cooper engine is being built for the Boston Manufacturing Company, which is preparing to enlarge its cotton mill at Waltham, Mass.

An enterprise which may, if it succeeds, have an important bearing upon the international iron trade is on foot in Great Britain. This is the formation of a company capitalized at $10,000,000 to utilize the ore deposits on the west coast of Norway by employing Mr. Edison's patent for concentrating iron ore. It is stated that

many of the principal British ironmasters have taken stock in the company. The tendency of a successful result of the scheme would be to render England independent of American supplies. The new factor of industry may be watched with especial interest because of its relation to the latent question of an ore monopoly in the holdings of the United States Steel Corporation.

Some interest must be felt by machine tool manufacturers in the decision of the Chicago, Milwaukee & St. Paul Railway Company to expend $800,000 during the next two years in enlarging its shops in the Menominee Valley at West Milwaukee.

The Stanley Instrument Company, manufacturer of electrical instruments, Great Barrington, Mass., has orders placed for $15,000 worth of new machinery—automatic screw machines, lathes, drills, grinders, etc., for immediate use. Some of this is now coming in and it is hoped to have the machines in operation by July 1. A fuel oil plant is one of the improvements. The company will probably be in the market for a good deal more machinery before long, since it is planning to enlarge its works about five-fold in size.

A. W. Gump, of Dayton, Ohio, formerly manager of the Shelby Cycle Manufacturing Company, has bought the entire contents of that plant, consisting of screw machines, automatics, punch presses, lathes, etc. This stock has been moved to Dayton, where it will be offered for sale, except a part of the machinery which will be used to manufacture special lines of metal goods for the general trade.

The Northern Engineering Works, Detroit, Mich., have been awarded the contract for a special double hoist, 15-ton electric traveling crane, for handling billets for the Republic Iron & Steel Company's Youngstown plant.

The Sprague Electric Company has recently received an order from the Pennsylvania Steel Company for ten 5-ton worm-gear electric trolley hoists for use in the new bridge shop at Steelton, Pa.

CHICAGO MACHINERY MARKET.

Formerly when a country manufacturer came to Chicago to buy machinery, remarked a prominent seller one day last week, he came to purchase whatever he could find and accordingly he shopped around a great deal. If it was a lathe he wanted, he looked at all the lathes in the market before making his choice. Now he wants a particular lathe. He knows all about it and about all other lathes. He looks only at the place where it can be found and his presence in the city is not known to the general trade, all of which is an evidence that education is abroad in the West. This condition may account for the statement frequently made of late that a larger percentage of inquiries develop into orders than ever before, though the urgency of the needs of the buyer must not be overlooked in accounting for the greater ease of making sales.

The buying of machine tools continues to be a succession of small and medium-sized orders. A few transactions for large equipments are reported, but they are not especially notable. The railroads are buying moderately well, but mainly for the old shops and for a few tools only, though for modern and specialized ones. A number of local sellers report business fully up to anything in recent times, but on the whole there is perhaps some falling away of the agggregate trade. One dealer expresses it by saying that summer quiet has come upon the trade earlier than expected, that there has been a gradual falling away of orders, but that the aggregate business continues fairly satisfactory.

Shop reports, however, give nothing but in ications of continued activity. In some lines Eastern manufacturers of tools are said to be catching up with their orders, but the common report here is that deliveries are greatly delayed. Store stocks are often broken. When a machine standing on the floor is sold it is often impossible to secure another of the same kind to take its place. To secure prompt shipment, said one dealer, tools must be ordered about sixty days in advance. Prices are generally firm, with here and there a slight advance.

The Railway Supply Company reports an excellent demand for saws. Trade is stimulated by the remarkable activity in construction of buildings, but the impossibility of procuring structural shapes for many prospective enterprises puts a limit to this activity. However, the company is selling all the product it can turn out.

Quotations.

NEW YORK, Monday, May 12.

Pennsylvania Foundry Pig Iron, Jersey City delivery:

No. 1 X	$20 15	@$20 65
No. 2 X	19 65	@ 20 15
No. 2 plain	19 15	@ 19 65
Gray forge	18 65	@ 19 15

Alabama Pig, New York delivery:

No. 1 foundry, or soft	19 25	@ 20 25
No. 2 foundry, or soft	18 75	@ 19 75
No. 3 foundry	18 25	@ 19 25
Foundry forge, or No. 4	17 25	@ 18 25

Bar Iron—Base sizes—Refined brands, mill price on dock, 1.93 @ 2.03c. in carload lots. Smaller quantities from store, about 2.10 @ 2.25c.

Tool Steel—Base sizes—Good standard quality, 7c.; extra grades, 10c. and upward.

Machinery Steel—Base sizes—From store, 2 @ 2¼c.

Cold Rolled Steel Shafting—Base sizes—From store, 2¾c.

Copper—Lake ingot, 12 @ 12⅛c.; electrolytic, 11⅝ @ 12c.; casting, 11⅝ @ 11¾c.

Pig Tin—In 5- and 10-ton lots, f. o. b., New York, 30¼ @ 30½c.

Pig Lead—4.10 @ 4.12½c. in 50-ton lots.

Spelter—4.35 @ 4.37½c., New York delivery.

Antimony—Cookson's, 10 @ 10¼c.; Hallett's, 8¼c.; U. S., 8 @ 8⅛c.; various brands, 8c.

Lard Oil—Prime City, 80 @ 85c.

New Catalogs.

The Keasey Pulley Company, Toledo, O., has published a new catalog of Keasey split wood pulleys with malleable-iron hubs. It is 3½x6¼ inches.

The Western Electric Company, Chicago, Ill., has sent us a copy of its 1902 fan motor catalog and price list. The pamphlet is 7¾x10½ inches in size.

The Fawcus Machine Company, 2820 Smallman street, Pittsburgh, Pa., sends a pamphlet (4¼x6⅛ inches) containing a few illustrations and prices of gears.

The Pittsburgh Gage & Supply Company, Pittsburgh, Pa., has sent us a pamphlet (6x9 inches, standard size) describing the White Star oil filtering system.

The Commercial Electric Company, Indianapolis, Ind., has sent us a good-sized catalog, composed of bound-up circulars, of dynamos and motors, etc. It is 6x8¾ inches.

The Jenney Electric Manufacturing Company, Indianapolis, Ind., has sent us pamphlets (7x10 inches) concerning multipolar dynamos, universal motors and linotype motors.

The American Arithmometer Company, St. Louis, Mo., has published an interesting little pamphlet (size of page standard, 3½x6 inches) describing the Burroughs registering accountant.

The Aurora Tool Works, Aurora, Ind., have published catalog No. 7, showing a line of upright, radial, post, multi-spindle and pump-boring drills and plain milling machines. It is 6x9 inches, standard size.

We have received a catalog of Baldwin acetylene lamps "for drifts, tunnels and mines of every sort, or wherever open-flame lamps can be used." They are manufacured by A. H. Funke, 101 Duane street, New York.

Henry Carey Baird & Co., industrial publishers, booksellers and importers, 810 Walnut street, Philadelphia, Pa., have brought out a new edition of their general catalog of practical and scientific books. It is 5⅞x9¼ inches.

The "Long-Arm" System Company, Cleveland, O., has sent us a pamphlet descriptive of the "Long-Arm" system of power doors and hatch gears for the preservation of life and property at sea. It is 6x9 inches, standard size.

The De Witt Wire Cloth Company, 17 Warren street, New York, has published catalog No. 71 relating to galvanized steel wire nettings, wire cloth of different metals and wire work for varied uses. It is 3½x6 inches, standard size.

We have received from Hilles & Jones Company, Wilmington, Del., Catalog "8," of machine tools for working plates, bars and structural shapes. It is 9x9 inches in size and is very strikingly bound in a cover of stiffened burlap or sacking.

The George Gorton Machine Company, Racine, Wis., has sent us a pamphlet (6x9 inches, standard size) describing its No. 1 engraving machine, another containing instructions for erecting and operating the machine and attachments, while a third pamphlet (6x9¾ inches) is entitled "The Whereabouts of 230 Engraving Machines."

We have received from the Eastwood Wire Manufacturing Company, Belleville, N. J., a catalog of engineering and other specialties. These include a variety of valves and fittings, perforated metals, cylinder molds, iron and bronze gears and propellers, smelting kettles, babbitt metals, a bronze digester, etc. The catalog contains prices, tables of useful information and cost ledger pages. It is 3¾x7 inches.

New Corporations.

F. Ferguson & Son, 1122 Clinton street, Hoboken, N. J.; object, manufacturing machinery, tools, etc.; capital, $50,000. Incorporators: Fergus M. Ferguson, John Ferguson, Margaret Ferguson and Janet Ferguson.

Boston Steel & Iron Co., 765 Broad street, Newark, N. J.; object, manufacturing steel, iron, etc.; capital, $1,000,000. Incorporators: E. M. Mabie, Geo. F. Maguire, Edward E. Dean, Herbert D. Cohen and Nathan F. Giffin.

J. K. Tomlinson Manufacturing Co.; principal office, 185 Mongomery street, Jersey City, N. J.; object, manufacturing feed water heaters; capital, $40,000. Incorporators: J. K. Tomlinson, Geo. R. Allison and H. G. C. Thornton.

Sanitary Road Machine Co. of America; object, making and dealing in automobiles, fire engines and street watering machines; capital stock, $500,000; president, C. W. Collyer, Lynn, Mass.; treasurer, J. G. Norton, Boston, Mass.

The Niles Sheet Metal Lath Company has been incorporated in Ohio with a capital stock of $200,000. The incorporators are Wade A. Taylor, of Niles; John F. O'Dea, of Youngstown, and others. A plant is to be built at Niles.

Thorneycroft Motor Wagon Co. of America; Corporation Trust Co., 15 Exchange place, Jersey City, N. J.; object, manufacturing motor vehicles; capital, $900,000. Incorporators: Robert H. Thorpe, John Platt and Hubert F. Warner.

Tri-Metal Bearing & Supply Co.; principal office, Corporation Trust Co., 15 Exchange place, Jersey City, N. J.; object, manufacturing railway supplies; capital, $1,000,000. Incorporators: K. K. McLaren, Louis B. Dailey, H. O. Coughlin.

American Furnace & Machine Company; principal office, 419 Market street, Camden, N. J.; object, manufacturing furnaces; capital, $100,000. Incorporators: Joseph A. Null, James H. Swindell and James D. Swindell, all of Pittsburgh, Pa.

American Fuel Saver Corporation; principal office, 76 Montgomery street, Jersey City, N. J.; object, manufacturing patented fuel-saving devices; capital, $125,000. Incorporators: Frank C. Porter, E. Francis Crane and Wm. Berger, all of Jersey City, N. J.

General Refrigerator Co. of America; capital, $1,000,000; object, manufacturing ice-making and other cooling machines. Incorporators: T. Lloyd McConchie, of New York; Raymond E. Dodge, of New York, and Hilman C. Carriere, of East Orange, N. J.

The Western Steel Car & Foundry Company has been incorporated in New Jersey (capital, $1,250,000) to manufacture cars and do a general foundry business. The incorporators are J. A. Williamson, Davis D. Woodruff and William B. Denton, all of Jersey City.

The Colonial Lumber & Box Company, with a capital stock of $15,000,000, has been incorporated by William T. Hunter, of Arlington, N. J., and George F. Holmes, Frank H. Lord, Cecil D. Giles and James J. Morgan, all of New York. The company will manufacture lumber and boxes.

Safety Insulated Wire & Cable Co.; principal office, Corporation Trust Co., 15 Exchange place, Jersey City, N. J.; object, manufacturing insulated wire, etc.; capital, $1,500,000. Incorporators: Ira W. Henry, Le Roy Clarke, Jr.; J. H. Lehman, S. Girard Fox, H. Gouet and others.

An association of Fort Collins (Colo.) beet-growers has been incorporated with a capital stock of $100,000, and with the announced intention of building and operating a sugar plant. The incorporators are Charles L. Evans, P. J. McHugh, Frank P. Stover, Thomas H. Robertson, A. H. Moody, Charles A. Bloom and August C. Kluver.

The Packers' Sanitary Can Company has been organized, with a capital of $500,000, to manufacture tin cans. The incorporators are William C. Bryant and John Murphy. The new company, which has a patent can and also a patent machine, was organized to can fruit and vegetables under the vacuum process. It is understood that the company will be operated in conjunction with the Can Trust.

Bordentown Mobile & Transportation Co.; principal office, Bordentown, N. J.; object, manufacturing electric mobiles; capital, $50,000. Incorporators: Lewis O. Vandergrift, Jesse Smith, Edward K. Minnick, James A. Masterson, James W. Cain, Robert A. Holloway, Edward D. Preston, Frank P. Gray, W. F. Densnap, Wm. C. Steele, James S. Gilbert, Geo. W. Shreeve, Peter J. Magee, David O. Berrian.

Manufacturers.

The Lizzie Lowman Stove Works, Sheffield, Ala., are to be enlarged.

The Michigan Buggy Company, Kalamazoo, Mich., will erect a new plant.

A factory building is being put up for the Cleveland (O.) Nickel Company.

A smelting shop is to be built for the Ajax Metal Company, Philadelphia, Pa.

The Seaboard Air Line Railway is making additions to its foundry at Portsmouth, Va.

Mason Sherwood, of Livingston Manor, N. Y., may locate a turning factory in Monticello.

The Lamb Knitting Machine Company, Chicopee, Mass., is about to erect a new building.

The Columbus (O.) Wire & Iron Works will erect a new manufacturing building, 90x250 feet.

The Phillips Insulated Wire Company, of Pawtucket, R. I., is to build an addition to its plant.

The Parkesburg (Pa.) Iron Company, rolling mill, is about to enlarge the capacity of its works.

The Ames-Dean Carriage Company, Jackson, Mich., will build a 250x80-foot, three-story factory.

Excavations have been begun for buildings of the Anderson Spring Steel Fence Company, Anderson, Ind.

Ground has been broken for the first building of the Magneto-Electric Company, Amsterdam, N. Y.

The F. S. Walton Company, oils, Philadelphia, Pa., has bought a site for a new manufacturing plant.

M. S. Brooks & Sons, manufacturers of bright wire goods, Chester, Conn., are building an addition.

The Wayne Junction Metal Company is about to erect a new factory building in Philadelphia, Pa.

Wm. Burgess & Co., East Liverpool, O., manufacturers of stilts, spurs and pins, will erect a new plant.

The Nonpareil Cork Manufacturing Company, of Camden, N. J., is about to erect three new buildings.

A permit has been issued for a building at Milwaukee, Wis., to be occupied by the Phoenix Knitting Works.

An additional molding building is to be built at the plant of the International Heater Company, Utica, N. Y.

Frick & Lindsay Company, mine and mill supplies, Pittsburgh, Pa., has moved into new quarters at 109 Wood street.

A building is being erected at St. Louis, Mo., which will be occupied by the Columbia Incandescent Lamp Company.

The American Optical Company, Southbridge, Mass., will erect an addition of 100 feet to machine shop building.

A Chicago building permit has been granted the Western Foundry Company for an addition at 3639-49 Kedzie avenue.

A new mill is being built by the Whiting Paper Company, of 150 Duane street, New York city, in North Wilbraham, Mass.

Surveys have been made for an addition to the cotton mills of the Paul Whitin Manufacturing Company, Northbridge, Mass.

The International Time Recording Company, Binghamton, N. Y., will build a five-story and basement structure, 110x44 feet.

Work has begun on the addition to the factory at Mansfield, Mass., of the S. W. Card Company, manufacturer of taps, dies, etc.

The McGinty File & Feed Gauge Company, Wilmington, Del., expects to have a new factory at Wayne Junction, Pa., completed by July 1.

The American Copper Extraction Company, 65 Wall street, New York, whose plant at Garwood, N. J., was recently burned, has decided to rebuild.

A foundry building is being remodeled to be occupied by the M. B. Schenck Company, manufacturer of Yale and Gem castors, Meriden, Conn.

The American Tube & Stamping Company, Bridgeport, Conn., has purchased a tract in East Bridgeport for a site for a proposed large plant.

A 98x150-foot addition will be built to the foundry of James Barker, machinist and iron founder, at Sixth and Cayuga streets, Philadelphia, Pa.

Work is soon to begin on a building for the New Roads Oil Mill, New Roads, La. P. V. Rougon is president and P. A. Fitzhugh general manager.

J. E. Fricke Company, Philadelphia, Pa., manufacturer of twines, has awarded contracts to build additions to its mills at Hulmeville, Pa.

A permit has been granted to Charles L. Moffett to erect a building, 20x30 feet, for foundry purposes at 710 La Grande avenue, Plainfield, N. J.

The Acme Bed Spring Factory has received a building permit for a factory at 414-420 West Forty-third street, Chicago, Ill.; estimated cost, $20,000.

James H. Wells has sold the machinery and business of the Tampa (Fla.) Machine Works to F. S. Parcell, but will continue the shafting straightener business.

A three-story mill, 50x84 feet, and a boiler-house, 15x35 feet, are to be built for Horace Linton & Bro., manufacturers of narrow fabrics, Philadelphia, Pa.

New buildings are being erected by the Kitson Machine Company and the Lowell Machine Shop, both manufacturers of textile machinery, Lowell, Mass.

The Columbus (O.) Chain Company has awarded contracts for two factory buildings, which when completed will give it a floor space of 30,000 square feet.

Plans have been prepared for an additional manufacturing building, 65x400 feet, for the Ivins-Dietz & Metzgar Company, manufacturer of carpets, Philadelphia, Pa.

The Astoria Silk Works, Steinway, Borough of Queens, New York city, are being extended, and it is expected that the plant at Unionport, N. Y., will be moved to Steinway.

The Virginia-Carolina Chemical Company will establish a 75,000-ton-a-year fertilizer plant at Montgomery, Ala., and contemplates starting other new ones in other places.

The Standard Oil Company will have an extension built to its Constable Hook (Bayonne, N. J.) plant. Twenty-four more stills, with a capacity of 1,250 barrels each, will be built.

The factory at 208 Broadway, Cambridge, Mass., has been leased to the Doten-Dunten Desk Company. It has 50,000 feet floor surface. The firm will equip the works with machinery.

It is said that a clutch and pulley works at Westfield, N. Y., owned by Brown & Thomas, of Erie, Pa., which was destroyed by fire a few days ago, may be rebuilt in Buffalo on a larger scale.

Contracts have been awarded by the Northwestern Malleable Iron Company, Milwaukee, Wis., for a new factory building to be used for the manufacture of chain belts. Its general dimensions will be 60x140 feet.

Stuart Lindsley and J. F. Holmes, Sr., of Orange, N. J., officers of the Remington Metalic Cartridge Company, were going to Ilion, N. Y., recently to meet the committee to arrange for the site of their new factory.

Sanger Bros., Waco, Tex., will construct an electric light, steam heat, elevator propelling and fan supplying power plant. Two 75 horse-power boilers will be installed, constructed so they will burn either oil or coal.

The Baltimore & Ohio has recently purchased 1,000 acres of land fronting the Potomac, at Keyser, W. Va., where it will build car shops to employ 1,500 men and machine and construction shops to employ 400.

The foundation for the Alliance (O.) Machine Company's plant has been laid and the structural iron is on the ground. The firm already has $100,000 amount of orders. Ground has also been broken for the Alliance Bolt & Nut Works.

The Millers River Manufacturing Company, blankets, etc., Athol, Mass., is beginning to make an enlargement at its factory. It is the intention of the company to instal a 100 horse-power engine, which it is hoped to have in place about July 1.

It is stated at Beloit, Wis., that R. H. Fulton and George Westaway have begun the erection of a factory in South Beloit, just across the State line. They will manufacture articles for fine interior finish of houses and run a foundry for job work.

Incorporators of the Richmond (Va.) Foundry & Manufacturing Company, of which Arthur Scrivenor is president, have purchased a site and will engage in the manufacture of castings, forgings, patterns and specialties. Mr. Scrivenor will be the general manager.

The Connecticut Railway & Lighting Company has purchased property in Shelton, on which it is said the company intends to erect a large power plant to supply its railway in that section and also power for manufacturing and other concerns in the lower Naugatuck Valley.

J. L. Dyer, of Pennsylvania, will erect a carriage, wagon and street car works in Birmingham, Ala. This statement is made by W. H. Morris, who has returned to Birmingham from a trip to Pennsylvania and other points in the East, in the interest of the Commercial Club.

The H. Adler Company, 241 First avenue, Pittsburgh, Pa., will erect a factory at Carnegie for the manufacture of gasoline stoves and ranges. It will comprise a 70x150-foot foundry, a press room, an engine-house and other buildings. A 100 horse-power gas engine will furnish power.

Councilman Charles F. Dunbar, Buffalo, N. Y., has just bought six acres of land on Winchester avenue. It is said that Detroit capitalists are interested with Mr. Dunbar in a big foundry that is expected to be built on the site at once, and for which the plans are made and ready for bids.

The National Iron Company, Duluth, Minn., will erect a new building this summer if satisfactory arrangements for a site are made. The plans are for a brick building, 400x250 feet, part of which will be two stories, and which will contain the foundry, pattern rooms and machine shop.

It is reported that the John A. Roebling's Sons Company, of Trenton, N. J., has completed negotiations for the purchase of a tract of land near St. Louis, on which it will shortly build a branch factory for the company's line of products. The new plant will employ upward of 500 men.

Work is begining on the plant of the West Allis Malleable Iron & Chain Company, recently organized by W. H. Shenner and capitalists of the South Side, Milwaukee, Wis. The principal buildings will be a foundry and an annealing department. The plant will give employment to over 150 men.

The Kutztown Foundry & Machine Company, Kutztown, Pa., will enlarge its plant, increasing the capital stock from $50,000 to $100,000. A new machine shop will be erected, 100x100 feet; a new foundry, 130x200 feet, and a cleaning house, 35x80 feet. They will be operated as far as possible by electricity.

Plans for doubling the capacity of the new Vulcan Crucible Steel Works at Monaca, Pa., are being prepared. In addition to this it is proposed to add a rolling mill for bars and rounds, and a puddling furnace which will produce the muck bar for use in the steel plant. Much of the machinery for the additional mills has been ordered, and a portion of it has been shipped.

The Fairbanks Company has secured the premises at the northwest corner of Elm and Broome streets, New York city, embracing Nos. 186 and 188 Elm street and 416, 418, 420 and 422 Broome street, and has there concentrated all the various departments of its business, including scales, valves, gas and gasoline engines, machinery, trucks, factory and mill supplies.

The Stamford Woollen Company, which has been recently organized, has purchased a site in Stamford, Conn., where a plant will be erected which will give employment to between 300 and 400 operatives. The backers of the enterprise are John W. Nary and Arthur Schwartz, both of Syracuse, N. Y. It is expected that a plant which they own at Providence, R. I., will ultimately be combined with the Stamford plant.

The United States Steel Company, it is reported, will build a $3,000,000 plant in South Chicago, employing 5,000 men, for the American Bridge Company, one of its constituent companies. The plant is to be a duplicate of the works at Economy, Pa., with which it is now stated the company intends to go ahead. The Chicago plant will be used to concentrate the works of the western district and will be about one mile in length.

C. W. Constantine, who has returned to Springfield, O., from New York, says that John W. Bookwalter intends to erect a steel mill at Springfield, with a capital of a million dollars. Mr. Bookwalter has acquired patents for the rapid conversion of iron into steel. They are an improvement on the Bessemer process, whereby the blast is introduced on the side of the converter instead of on the bottom, thus preventing the overoxidation of the metal.

The Crane Company, manufacturer of pipe and fittings, has had in contemplation for several years the extension of its plant between Stewart avenue and Canal street, south of Twelfth, Chicago, Ill., including the construction of a large office building for its own use and the extension of its malleable iron plant, the whole involving $500,000. Over $100,000 worth of land adapted to this purpose has just been purchased, but it is not known how soon the buildings will be erected.

The Keystone Valve & Manufacturing Company has been incorporated in Pennsylvania with a capital stock of $100,000. It is composed largely of Pittsburgh men, temporary offices being located in Carson street, Southside. It is said that it will secure a site for a plant in a short time and will build a factory for the manufacture of valves, among them being a steam valve patented by Henry E. Keyes, of Homestead. The incorporators of the company are J. B. Riley, William A. Larimer, William R. McCulley, William J. Simpson and Stephen Mackay.

Miscellaneous Wants.

Advertisements will be inserted under this head at 25 cents a line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Gear Wheels, gear cutting. Grant; see p. 18.

Punches & dies. Wal.M.Wks.,Waltham,Mass.

Caliper cat. free. E. G. Smith, Columbia, Pa.

Patterns and models. 19 Thames st., N. Y.

Ohio Township Officers Directory for 1902, now ready. R. S. Strader, Columbus, O.

Will buy or pay royalty for good patented machine or tool. Box 282, AMER. MACH.

Fine machine and experimental work. The Des Jardins Type Justifier Co., Hartford, Ct.

Light and fine mach'y to order; models and elec. work specialty. E. O. Chase, Newark, N. J.

Light machine & experimental work; models made. S. Messerer, 15 Springf. av., Newark,N.J.

F. J. Stokes Machine Co., 13th and Noble sts., Philadelphia, Pa., build light machinery.

For Sale—One 4 H.P. Webster gas engine; good condition; bargain to quick buyer. Address A. K. Bowman, Greensburg, Pa.

Exchange patterns and tools for a full line of well-known machine tools (up to date and good sellers) for stock in any good concern. Box 692, Worcester, Mass.

Purchaser for complete sets of universal radial and plain upright drill patterns with drawings; for sale cheap. Address "Patterns," care AMERICAN MACHINIST.

Contract work wanted for small foundry and machine shop, used to doing good work only; operated by owner, member A. S. M. E. Address Box 469, AMERICAN MACHINIST.

An iron manufacturing company, employing 100 hands (mostly skilled) the year round, contemplates removal and should be pleased to receive propositions on change of location. Address Box X, AMERICAN MACHINIST.

Have several good inventions in shop tools bearing rigid investigation, having built same, but have not the money to patent and introduce; want money as partner; am practical machinist, daily at bench; best of references. Box 480, AMERICAN MACHINIST.

Purchaser for small manufacturing plant in Madison, Wis.; lot, 100x180 feet; machine shop, 32x68, two story, with line shaft and gasoline power; foundry, 40x54, new modern equipment; good location; for sale cheap. Hart-Parr Co., Charles City, Iowa.

Prof. Spangenberg's Practical Arithmetic for the Practical Mechanic; there are a great many mechanics who, through neglect or lack of opportunity, have forgotten what they knew about arithmetic; our new method requires no teacher; 194 pages; price 50 cents. G. A. Zeller, Pub., Room 590, 18 S. 4th st., St. Louis, Mo.

For Sale—Valuable real estate and machine shop in the city of Biddeford, Maine; the property known as the Hardy Machine Com-

pany, consisting of about thirty thousand (30,000) square feet of land, adjoining the track of the Boston & Maine R. R.; large three-story machine shop and foundry, with first-class machinery and tools for manufacturing the Hardy card grinder, and other machinery; the only general repair shop in this locality. For information apply to the President of the Company.

Wants.

Situation and Help Advertisements only inserted under this head. Rate 25 cents a line for each insertion. About six words make a line. No advertisements under two lines accepted, and no advertisements abbreviated. The cash and copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded. Applicants may specify names to which their replies are not to be forwarded; but replies will not be returned. If not forwarded they will be destroyed without notice. Original letters of recommendation or other papers of value should not be enclosed to unknown correspondents.

Situations Wanted.

Draftsman, mechanical, 12 years' experience, desires position. 19ox 406, AM. MACH.

First-class mechanical draftsman, technical education and shop practice, wants employment. Box 475, AMERICAN MACHINIST.

Position wanted as foreman or assistant; acquainted with interchangeable system; first-class tool and model maker. Box 474, AM. M.

A gun expert, designer, model and gage maker, technical education, age 34, inventive ability, is open for engagement. Box 478, AMERICAN MACHINIST.

Energetic, ambitious young draftsman desires change, with good chances for advancement by working; New England preferred. "Studious," care AMERICAN MACHINIST.

Draftsman, with 14 years' experience in shop and drawing room, wishes permanent position; have had charge of shop and drafting room. Box 481, AMERICAN MACHINIST.

Mechanical draftsman and machinist of broad experience, designer of tools, fixtures and special machinery, is open for engagement. Address Box 473, AMER. MACHINIST.

Young technical graduate, first-class mechanical draftsman, with some experience in steam pump and compressor construction, wants change. Box 486, AMER. MACHINIST.

Wanted—Position as foreman or superintendent of machine shop; can handle men to advantage; aggressive; of good habits; technical graduate; 20 years' practical experience. Box 482, AMERICAN MACHINIST.

Mechanical engineer and first-class designer desires a position in New York, Jersey City or vicinity; 20 years' experience in different lines; anything about engines and power plants, etc.; excellent testimonials. Box 459, AMERICAN MACHINIST.

Wanted—Position as general foreman or assistant superintendent, by a man who has held similar positions, doing general first-class work; thoroughly understands marine work, machine foundry and boiler departments; a good organizer. Address C. T. A., care A. M.

An assistant superintendent seeks change; a good executive, a technical and practical mechanical engineer, familiar with modern methods in successful shop and experienced in building medium size engines and general machine work. Box 487, AMER. MACHINIST.

Mechanical engineer, widely experienced, inventing and constructing labor-saving, intricate automatic machinery, devising special processes, etc., may be engaged for temporary or permanent work; technical graduate; member A. S. M. E., etc.; advertiser will not work for less than $500 per month, but guarantees satisfaction and results in anything he undertakes. Box 429, AMERICAN MACHINIST.

Help Wanted.

Machinists to sell my calipers, etc.; big inducements. E. G. Smith, Columbia, Pa.

Die-sinkers wanted, accustomed to drop forged work. The Kilborn & Bishop Co., New Haven, Conn.

Wanted—A number of good patternmakers. Call or address De Laval Steam Turbine Co., Trenton, N. J.

Wanted—All-round machinist; one used to gear cutting preferred. Boston Gear Works, 152 Purchase st., Boston, Mass.

Wanted—2 or 3 good, all-round machinists, in Detroit, Mich. Address, with references, Box 440, AMERICAN MACHINIST.

Wanted—Several good patternmakers, by a machine tool manufacturing works in Jersey. Box 179, AMERICAN MACHINIST.

Machinists—First-class, all-round mechanics; also floor hands. Bullock Electric Manufacturing Co., Cincinnati, Ohio.

Draftsman with experience in machine tool work; permanent position for right man. Address Box 462, AMERICAN MACHINIST.

A few first-class milling machine hands; a number of boring mill and lathe hands. Apply Washington and Essex st., Jersey City.

Patternmaker wanted; one accustomed to engine work preferred; give experience, wages, "Georgia," care AMERICAN MACHINIST.

Experienced draftsman on Corliss engines, also one on general machinery; give full statement of experience. Box 476, AM. M.

Gear Cutters.—Wanted, machinist for repair work on Brown & Sharpe gear cutters; steady work for right man. Box 479, AM. M.

Wanted—First-class tool and die makers; only those thoroughly up to date on this class of work need apply. Address Box 477, A. M.

Wanted—Foundry foreman at once; give full particulars and references in first letter. Address Atlanta Machine Works, Atlanta, Ga.

Wanted—A working foreman in shop building heavy machinery. Answer, stating experience, age and salary expected, Box 470, A. M.

Wanted—Foreman for a machine shop doing engine and general repairs and heavy manufacturing. George Smith, 72 Park av., Chicago.

Traveling salesmen, East and West, in dies, presses and a full line of can-making machinery, special and sheet metal working machinery. Address Box 488, AMER. MACH.

Wanted—Toolmakers on small interchangeable work in large factory on Staten Island, New York; state experience, references and wages expected. Address Box 467, AM. M.

Wanted—Mechanical draftsmen; permanent position; preferably with experience in gas works construction. Write, stating salary expected, to the Western Gas Construction Company, Fort Wayne, Ind.

Designer and draftsman familiar with structural iron work and mill construction; knowledge of conveying machinery desirable; state age, experience and salary expected. Address Box J, Niagara Falls, N. Y.

Wanted—First-class patternmaker as foreman of large valve and flange fitting pattern room; must be capable of taking charge of both wood and metal pattern work; state age, experience and salary wanted. Box 471, A. M.

Machinists wanted to act as shop agents and sell small tools where they work; send 44 cents for 6 in. tempered scale, No. 4, warranted; shall give a gold watch to some good agent. E. H. Randall, 235 Woodlawn ave., Springfield, Ohio.

We are enlarging our works, and will shortly require an increased number of skilled mechanics; we invite application from pattern makers, molders and machinists. Address the Westinghouse Machine Company, East Pittsburgh, Pa.

Wanted—A thoroughly experienced and trained chief draftsman familiar with Corliss and high speed engines and competent to take charge of the drafting room of an active, working establishment. Address XX, care AMERICAN MACHINIST.

Wanted—Foundry foreman for shop employing about 40 molders; heavy and light engine work; jacketed cylinders up to 36 inches; permanent position; good salary and prospects for right man. Address C. A. F., care AMERICAN MACHINIST.

Wanted—A foreman foundryman to give instruction in a technical school (New York) for a period of three weeks in June; should be a man between 25 and 50 years of age, with broad experience. Address "Teacher," care AMERICAN MACHINIST.

Wanted—By large manufacturing concern in Middle West, young man who has had experience in figuring manufacturing costs on machinery; permanent position and good opportunity for intelligent, energetic man. Advise, with full particulars, Box 485, AM. M.

Wanted—Thoroughly competent foreman on machine tool building, experienced in building pipe threading machinery, familiar with methods of producing duplicate parts on turret lathes; give age, experience, salary expected and references. Box 237, AMER. MACH.

Chief Draftsman.—Wanted—A thoroughly capable and experienced foreman of drafting room, designer, etc., familiar with highest class engine and machine tool work, and preferably having some electrical experience as well. Address in confidence, with full particulars, salary expected, etc., Box 484, A. M.

Wanted—Engineer for small steam and electric plant, 20 miles from New York; must be capable taking charge of steam, hydraulic and electric machinery and storage battery, have some knowledge of drawing; must speak German; state experience, references, wages, etc. Address "Factory," P. O. Box 6, Branch O, New York City.

Wanted—For position in New York, young man, graduate in steam engineering (electrical education not required); applicants must have thorough theoretical knowledge as well as practical experience concerning boilers, engines, piping, etc.; duties will be partly engineering and partly executive; state college, salary, experience and references. Address Box 472, AMERICAN MACHINIST.

A company manufacturing electric railway materials and located in north central Ohio, requires an assistant to the superintendent; must be familiar with shop practice and methods and capable of handling men; applicants should be between 28 and 35 years of age and able to furnish references. Address, stating age, previous experience and salary required, "Assistant Superintendent No 18," care AMERICAN MACHINIST.

A working foreman, by light specialty stamping concern in a beautiful Western city of 60,000 inhabitants; applicant must be a practical toolmaker and must thoroughly understand diemaking in all its branches; a good opportunity for the right man; none need apply unless honest, sober, industrious and able to furnish the best of reference; state least salary expected, age and if married or single; one who has had experience in the manufacture of metal screw bottle caps preferred. Write fully and address "Manufacturers," Box 483, AMERICAN MACHINIST.

Wanted—Ice machine salesmen; we are in need of two first-class salesmen, whom we expect to be hard and energetic workers, to sell our machines; the right men with experience will have an opportunity to find permanent employment with good remuneration; their character must be irreproachable and they must be able to give first-class references; all applications must be in writing, addressed to the General Manager, and must state previous experience, age, if married or single, references and salary expected; no interviews desired except at our request. The De La Vergne Refrigerating Machine Co., foot of East 138th st., New York, N. Y.

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Bullard Mach. Tool Co., Bridgeport, Conn.
Hill, Clarke & Co., Boston, Mass.
Niles Tool Works Co., New York.
Pond Mach. Tool Co., New York.
Warner & Swasey Co., Cleveland, Ohio.

Boring and Drilling Machines, Horizontal
Barnes Co., B. F., Rockford, Ill.
Barnes Co., W. F. & John, Rockford, Ill.
Beaman & Smith Co., Provi., R. I.
Bement, Miles & Co., N. Y. City.
Betts Mach. Co., Wilmington, Del.
Binsse Macn. Co., Newark, N. J.
Dallett & Co., Thos. H., Phila., Pa.
Detrick & Harvey Mach. Co., Baltimore, Md.
Fosdick & Holloway Mach. Tool Co., Cincinnati, O.
Franklin Mach. Wks., Phila., Pa.
Jones Fdry. & Mch. Co., W. A., Chicago, Ill.
Newton Mach. Tool Wks., Philadelphia, Pa.
Niles Tool Works Co., New York.
Pond Mach. Tool Co., New York.
Pratt & Whitney Co., Hartford, Conn.
Warner & Swasey Co., Cleveland, Ohio.

Carborundum
See Grinding.

Castings, Aluminum
McKenna & Bro., Jas. J., New York.

Castings, Brass and Bronze
Christensen Engineering Co., Milwaukee, Wis.

Castings, Die Molded
Franklin Mfg. Co., Syracuse, N. Y.

Castings, Steel
Acme Steel & Mall. Iron Works, Buffalo, N. Y.
Christensen Engineering Co., Milwaukee, Wis.
Uniform Steel Co., Newark, N. J.
U. S. Steel Co., Everett, Mass.

Centers, Planer
Fay & Scott, Dexter, Me.
New Haven Mfg. Co., New Haven, Conn.
Pratt & Whitney Co., Hartford, Conn.
Reed Co., F. E., Worcester, Mass.

Centering Machines
Bement, Miles & Co., New York.
Kempsmith Mfg. Co., Milwaukee, Wis.
Niles Tool Works Co., New York.
Phoenix Mfg. Co., Hartford, Conn.
Pond Mach. Tool Co., New York.
Whiton Machine Co., D. E., New London, Conn.

Chains, Driving
Automobile & Cycle Parts Co., Cleveland, O.
Boston Gear Works, Boston, Mass.
Bridgeport Chain Co., Bridgeport, Conn.
Jeffrey Mfg. Co., The, Columbus, Ohio.
Link Belt Engr. Co., Phila., Pa.
Whitney Mfg. Co., Hartford, Ct.

Chucking Machines
Cleveland Mach. Screw Co., Cleveland, O.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
Potter & Johnston Mach. Co., Pawtucket, R. I.
Pratt & Whitney Co., Hartford, Conn.
Reed Co., F. E., Worcester, Mass.
Warner & Swasey Co., Cleveland, Ohio.
Windsor Mach. Co., Windsor, Vt.

Chucks, Drill
Almond, T. R., Brooklyn, N. Y.
Brown & Co., R. H., New Haven, Conn.
Cleveland Twist Drill Co., Cleveland, O.
Goodell-Pratt Co., Greenfield, Mass.
The E. Horton & Sons Co., Windsor Locks, Conn.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Pratt Chuck Co., Frankfort, N. Y.
Standard Tool Co., Cleveland, O.
Trump Bros. Mach. Co., Wilmington, Del.
Whitney Mfg. Co., Hartford, Ct.
Whiton Mach. Co., D. E., New London, Conn.

Chucks, Split
Faneuil Watch Tool Co., Boston, Mass.

Chucks, Lathe
Cushman Chuck Co., Hartford, Ct.
Hoggson & Pettis Mfg. Co., New Haven, Conn.
The E. Horton & Sons Co., Windsor Locks, Conn.
Pratt & Whitney Co., Hartford, Conn.
Skinner Chuck Co., New Britain, Conn.
Westcott Chuck Co., Oneida, N. Y.
Whiton Mach. Co., D. E., New London, Conn.

Clutches, Friction
Caldwell, Son & Co., H. W., Chicago, Ill.
Faneuil Watch Tool Co., Boston, Mass.
Jones Fdry. & Mch. Co., W. A., Chicago, Ill.
New Haven Mfg. Co., New Haven, Conn.
Oesterlein Mach. Co., Cincin., O.
Patterson, Gottfried & Hunter, Ltd., New York.
Pratt & Whitney Co., Hartford, Conn.

Collars, Split
Central Fdry. & Mch. Co., Reading, Pa.

Compressors, Air
Blanchard Mach. Co., Boston, Mass.
Chicago Pneumatic Tool Co., Chicago, Ill.
Christensen Engineering Co., Milwaukee, Wis.
Curtis & Co. Mfg. Co., St. Louis, Mo.
Herron & Bury Mfg. Co., Erie, Pa.
Ingersoll-Sergeant Drill Co., New York.
Rand Drill Co., New York.

Consulting Engineer
Thompson, Hugh L., Waterbury, Conn.

Coping Machines
Long & Allstatter Co., Hamilton, Ohio.

Correspondence Schools
See Schools, Correspondence.

Counters, Machinery
Veeder Mfg. Co., Hartford, Conn.

Countershafts
Builders' Iron Fdry., Provi., R. I.
Oesterlein Mach. Co., Cincin., O.
Pratt & Whitney Co., Hartford, Conn.
Reeves Pulley Co., Columbus, Ind.
Wilmarth & Morman Co., Grand Rapids, Mich.

Couplings, Shaft
Cresson Co., Geo. V., Philadel., Pa.
Davis Mach. Co., W. P., Rochester, N. Y.
Jones Fdry. & Mch. Co., W. A., Chicago, Ill.
Patterson, Gottfried & Hunter, Ltd., New York.
Stuart, R. J., New Hamburg, N. Y.

Counting and Printing Wheels
Franklin Mfg. Co., Syracuse, N. Y.
Grant Mfg. & Mach. Co., Bridgeport, Conn.

Cranes
Brown Hoisting Mach. Co., N. Y. City.
Chicago Pneumatic Tool Co., Chicago, Ill.
Cleveland Crane & Car Co., Cleveland, O.
Curtis & Co. Mfg. Co., St. Louis, Mo.
Franklin Portable Crane & Hoist Co., Franklin, Pa.
Maris Bros., Philadelphia, Pa.
Moyer & Co., J. W., Philadel., Pa.
Niles-Bement-Pond Co., New York.
Northern Engineering Works, Detroit, Mich.
North Penn. Iron Co., Phila., Pa.
Pawling & Harnischfeger, Milwaukee, Wis.
Sellers & Co., Wm., Philadel., Pa.
Whiting Foundry Equipment Co., Harvey, Ill.

Crank Pin Turning Machines
Underwood & Co., H. B., Philadelphia, Pa.

Cupolas, and Ladles, Foundry
Northern Engr. Works, Detroit, Mich.
Obermayer Co., S., Cincinnati, O.
Whiting Foundry Equip. Co., Harvey, Ill.

Crucibles
Dixon Crucible Co., Jos., Jersey City, N. J.

Cutters, Milling
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Twist Drill Co., Cleveland, O.
Gay & Ward, Athol, Mass.
Ingersoll Milling Mach. Co., Rockford, Ill.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Rogers, John M., Boat, Gage & Drill Works, Gloucetser City, N. J.
Standard Tool Co., Cleveland, O.

Cutting off Machines
Bement, Miles & Co., New York.
Davis Mach. Co., W. P., Rochester, N. Y.
Franklin Mach. Wks., Phila., Pa.
Hurlbut-Rogers Mach. Co., South Sudbury, Mass.
Newton Mach. Tool Wks., Philadelphia, Pa.
Niles Tool Works Co., New York.
Pond Mach. Tool Co., New York.

Cutting off Tools
Armstrong Bros. Tool Co., Chicago, Ill.
Pratt & Whitney Co., Hartford, Conn.

Cyclometers
Veeder Mfg. Co., Hartford, Conn.

Diamond Tools
Dickinson, Thos. L., New York.

Dies, Sheet Metal
Bliss Co., E. W., Brooklyn, N. Y.

Drawing Instruments
Keuffel & Esser Co., New York.

Drilling Machines, Bench
Barnes Co., W. F. & John, Rockford, Ill.
Pratt & Whitney Co., Hartford, Conn.

Drilling Machines, Boiler
Baush Mch. Tool Co., Springfield, Mass.
Bickford Drill & Tool Co., Cincinnati, O.
Bement, Miles & Co., New York.
Dallett & Co., Thos. H., Phila., Pa.
Niles Tool Works Co., New York.
Pond Mach. Tool Co., New York.

Drilling Machines, Multiple Spindle
Baker Bros., Toledo, O.
Barnes Co., B. F., Rockford, Ill.
Barnes Co., W. F. & John, Rockford, Ill.
Baush Mch. Tool Co., Springfield, Mass.
Bement, Miles & Co., New York.
Bickford Drill & Tool Co., Cincinnati, Ohio.
Dallett & Co., Thos. H., Phila., Pa.
Garvin Mach. Co., New York.
Harrington Son & Co., Edwin, Philadelphia, Pa.
Newton Machine Tool Works, Philadelphia, Pa.
Niles Tool Works Co., New York.

Drilling Machines, Portable
Dallett & Co., Thos. H., Phila., Pa.

Drilling Machines, Pneumatic
Chicago Pneumatic Tool Co., Chicago, Ill.
Cleveland Pneu. Tool Co., Cleveland, Ohio.
Phila. Pneumatic Tool Co., Philadelphia, Pa.

Drilling Machines, Radial
Amer. Tool Wks. Co., Cincin., O.
Baush Mch. Tool Co., Springfield, Mass.
Bement, Miles & Co., New York.
Bickford Drill & Tool Co., Cincinnati, Ohio.
Cleveland Punch & Shear Works Co., Cleveland, O.
Dreses Mach. Tool Co., Cincin., O.
Fosdick & Holloway M. T. Co., Cincinnati, O.
Gang Co., Wm. E., Cincinnati, O.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Hill, Clarke & Co., Boston, Mass.
Niles Tool Works Co., New York.
Pond Mach. Tool Co., New York.
Reade Mchry Co., Cleveland, O.

Drilling Machines, Turret
Niles Tool Works Co., New York.
Quint, A. D., Hartford, Conn.

Drilling Machines, Upright
Am. Tool Wks. Co., Cincinnati, O.
Baker Bros., Toledo, O.
Barnes Co., B. F., Rockford, Ill.
Barnes Co., W. F. & John, Rockford, Ill.
Bement, Miles & Co., New York.
Cincinnati Mach. Tool Co., Cin., O.
Davis Mach. Co., W. P., Rochester, N. Y.
Dwight Slate Mach. Co., Hartford, Conn.
Fosdick & Holloway Mach. Tool Co., Cincinnati, O.
Gould & Eberhardt, Newark, N. J.
Harrington & Son Co., Edwin, Philadelphia, Pa.
Hill, Clarke & Co., Boston, Mass.
Hoefer Mfg. Co., Freeport, Ill.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
Niles Tool Works Co., New York.
New Haven Mfg. Co., New Haven, Conn.
Pratt & Whitney Co., Hartford, Conn.
Sibley & Ware, South Bend, Ind.
Snyder, J. E., Worcester, Mass.
Washburn Shops, Worcester, Mass.

Drills, Center
Pratt & Whitney Co., Hartford, Conn.
Slocomb & Co., J. T., Providence, R. I.

Drills, Rail
Bement, Miles & Co., New York.
Niles Tool Works Co., New York.

Drills, Ratchet
Parker Co., Chas., Meriden, Ct.
Pratt & Whitney Co., Hartford, Conn.

Dust Collectors
Allington & Curtis Mfg. Co., Saginaw, Mich.

Dynamos
Akron Elec. Mfg. Co., Akron, O.
C & C Electric Co., New York.
Commercial Electric Co., Indianapolis, Ind.
Crocker-Wheeler Electric Co., Ampere, N. J.
Eck Dynamo & Motor Works, Belleville, N. J.
General Elec. Co., New York.
Jantz & Leist Elec. Co., Cincin., O.
Northern Elec. Mfg. Co., Madison, Wis.
Robbins & Myers Co., Springfield, Ohio.
Roth Bros. & Co., Chicago, Ill.
Sprague Elec. Co., New York.
Triumph Elec. Co., Cincinnati, O.
Westinghouse Electric & Mfg. Co., Pittsburgh, Pa.

Electrical Supplies
Akron Elec. Mfg. Co., Akron, O.
Commercial Electric Co., Indianapolis, Ind.
General Elec. Co., New York.
General Incan. Arc Light Co., New York.
Triumph Electric Co., Cincin., O.
Westinghouse Elec. & Mfg. Co., Pittsburgh, Pa.

Elevators
Albro-Clem Elevator Co., Philadelphia, Pa.
Howard Iron Works, Buffalo, N. Y.
Morse, Williams & Co., Phila., Pa.

Emery Wheels
See Grinding Wheels.

Enclosures, Tool-room
Merritt & Co., Philadelphia, Pa.

Engines, Gas and Gasoline
Charter Gas Engine Co., Sterling, Ill.
Columbus Mach. Co., Columbus, O.
Economy Engine Co., St. Joseph, Mich.
Foos Gas Eng. Co., Springfield, O.
Maywood Foundry & Mach. Co., Chicago, Ill.
Mietz, August, New York.
New Era Iron Wks., Dayton, O.
Olds Motor Wks., Lansing, Mich.
Patterson, Gottfried & Hunter, Ltd., New York.
Pierce-Crouch Engine Co., New Brighton, Pa.
Regal Gasoline Engine Co., Coldwater, Mich.
Springfield Gas Eng. Co., Springfield, O.
Stover Engine Works, Freeport, Ill.
Struthers, Wells & Co., Warren, Pa.
Weber Gas & Gasoline Eng. Co., Kansas City, Mo.

Engines, Steam
Buffalo Forge Co., Buffalo, N. Y.
Chandler & Taylor Co., Indianapolis, Ind.
Frick Co., Waynesboro, Pa.
Rand Drill Co., New York.

Engine Stop
Consolidated Engine Stop Co., New York.

Exhaust Fans
Buffalo Forge Co., Buffalo, N. Y.

Exhaust Heads
Burt Mfg. Co., Akron, O.

Fans, Electric
Northern Elec. Mfg. Co., Madison, Wis.
Sprague Elec. Co., New York.
Westinghouse Elec. & Mfg. Co., Pittsburgh, Pa.

Files and Rasps
Barnett Co., G. & H., Phila., Pa.
Hammacher, Schlemmer & Co., New York.
Nicholson File Co., Prov., R. I.

Fillers, Oil Can
The Winkley Co., Hartford, Conn.

Filters, Oil
Burt Mfg. Co., Akron, O.

Fittings, Steam
Crane Co., Chicago, Ill.
Crosby Steam Gage & Valve Co., Boston, Mass.
Jenkins Bros., New York.
Lunkenheimer Co., Cincinnati, O.
Walworth Mfg. Co., Boston, Mass.

Forges
Buffalo Forge Co., Buffalo, N. Y.
Miner & Peck Mfg. Co., New Haven, Conn.

Forgings, Drop
Billings & Spencer Co., Hartford, Conn.
Miner & Peck Mfg. Co., New Haven, Conn.
Williams & Co., J. H., Brooklyn, N. Y.
Wyman & Gordon, Worcester, Mass.

Forgings, Hydraulic
Wyman & Gordon, Worcester, Mass.

Forgings, Steel
Westmoreland Steel Co., Pittsburgh, Pa.
Wyman & Gordon, Worcester, Mass.

Foundry Furnishings
Obermayer Co., S., Cincinnati, O.
Whiting Foundry Equip. Co., Harvey, Ill.

Furnaces, Coal, Gas and Oil
Am. Gas Furnace Co., N. Y. City.
Buffalo Forge Co., Buffalo, N. Y.
Chicago Flexible Shaft Co., Chicago, Ill.

Furniture, Machine Shop
New Britain Mach. Co., New Britain, Conn.

Gage, Depth
Crescent Instrument Works, Dubuque, Iowa.

Gages, Recording
Bristol Co., Waterbury, Conn.

Gages, Standard
Brown & Sharpe Mfg. Co., Providence, R. I.
Rogers, John M., Boat, Gage & Drill Works, Gloucester City, N. J.
Sawyer Tool Mfg. Co., Fitchburg, Mass.
Slocomb & Co., J. T., Prov., R. I.
Starrett Co., L. S., Athol, Mass.

Gear Cutting Machinery
Bickford Drill & Tool Co., Cin., O.
Brown & Sharpe Mfg. Co., Providence, R. I.
Clough, R. M., Tolland, Conn.
Dwight Slate Mch Co., Hartford, Conn.
Fellows Gear Shaper Co., Springfield, Vt.
Gleason Tool Co., Rochester, N. Y.
Gould & Eberhardt, Newark, N. J.
Harrington & Son Co., Edwin, Philadelphia, Pa.
Newton Mch. Tool Wks., Phil., Pa.
Niles Tool Works Co., New York.
Whiton Machine Co., D. E., New London, Conn.

Gages, Steam
Crosby Steam Gage & Valve Co., Boston, Mass.

Gas Producers
Am. Gas Furnace Co., N. Y. City.

Gears, Cut
Bilgram, Hugo, Philadelphia, Pa.
Boston Gear Wks., Boston, Mass.
Cleveland Gear Wks., Cleveland, O.
Fawcus Mach. Co., Pittsburgh, Pa.
Fellows Gear Shaper Co., Springfield, Vt.
Gleason Tool Co., Rochester, N. Y.
Gould & Eberhardt, Newark, N. J.
Grant Gear Works, Boston, Mass.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Horsburgh & Scott, Cleveland, O.
New Process Raw Hide Co., Syracuse, N. Y.
Nuttall Co., R. D., Pittsburgh, Pa.
Philadelphia Gear Works, Philadelphia, Pa.
Simonds Mfg. Co., Pittsburgh, Pa.
Turley, H. G., St. Louis, Mo.
Van Dorn & Dutton Co., Cleveland, O.

Gears, Molded
Franklin Mfg. Co., Syracuse, N. Y.
Greenwald Co., I. & E., Cincin., O.
Poole & Son Co., Robt., Baltimore, Md.

Gears, Rawhide
Chicago Raw Hide Co., Chicago, Ill.
Fawcus Mch. Co., Pittsburgh, Pa.
New Process Raw Hide Co., Syracuse, N. Y.
Nuttall Co., R. D., Pittsburgh, Pa.

Gears, Worm
Albro-Clem Elevator Co., Philadelphia, Pa.
Fawcus Mach. Co., Pittsburgh, Pa.
Morse, Williams & Co., Phila., Pa.
Nuttall Co., R. D., Pittsburgh, Pa.
Simonds Mfg. Co., Pittsburgh, Pa.
Van Dorn & Dutton Co., Cleveland, O.

Graphite
Dixon Crucible Co., Jos., Jersey City, N. J.
Obermayer Co., S., Cincinnati, O.

Grinders, Center
Heald & Son, L. S., Barre, Mass.
Leland & Faulconer Mfg. Co., Detroit, Mich.

Grinders, Cock
Windsor Mach. Co., Windsor, Vt.

Grinders, Cutter
Adams Co., Dubuque, Iowa.
Automatic Mach. Co., Greenfield, Mass.
Cincinnati Milling Mach. Co., Cincinnati, O.
Garvin Mach. Co., New York.
Gleason Mach. Wks., F., Philadelphia, Pa.
Gould & Eberhardt, Newark, N. J.
Norton Emery Wheel Co., Worcester, Mass.
Oesterlein Mach. Co., Cincin., O.
Pratt & Whitney Co., Hartford, Conn.
Rivett- Dock Co., Boston, Mass.

Grinders, Disc
Besly & Co., Chas. H., Chicago, Ill.
Gorton Mach. Co., Geo., Racine, Wis.
Iroquois Mach. Co., Provi., R. I.
Ransom Mfg. Co., Oshkosh, Wis.

Grinders, Tool
Barnes Co., R. F., Rockford, Ill.
Barnes Co., W. F. & John, Rockford, Ill.
Diamond Mach. Co., Prov., R. I.
Gisholt Mach. Co., Madison, Wis.
Iroquois Mach. Co., Provi., R. I.
Landis Tool Co., Waynesboro, Pa.
Leland & Faulconer Mfg. Co., Detroit, Mich.
Northampton Emery Wheel Co., Leeds, Mass.
Oesterlein Mach. Co., Cincin., O.
Ransom Mfg. Co., Oshkosh, Wis.
Safety Emery Wheel Co., Springfield, O.
Whitney Mfg. Co., Hartford, Ct.

Grinders, Drill
Gorton Mach. Co., Geo., Racine, Wis.
Heald & Son, L. S., Barre, Mass.
Standard Tool Co., Cleveland, O.
Washburn Shops, Worcester, Mass.
Wilmarth & Morman Co., Grand Rapids, Mich.

Grinding Machines
Besly & Co., Chas. H., Chicago, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Builders' Iron Foundry, Providence, R. I.
Diamond Mach. Co., Prov. ,R. I.
Goodell-Pratt Co., Greenfield, Mass.
Gorton Mach. Co., Geo., Racine, Wis.
Hill, Clarke & Co., Boston, Mass.
Iroquois Mach. Co., Provi., R. I.
Landis Tool Co., Waynesboro, Pa.
Northampton Emery Wheel Co., Leeds, Mass.
Northern Elec. Mfg. Co., Madison, Wis.
Norton Emery Wheel Co., Worcester, Mass.
Ransom Mfg. Co., Oshkosh, Wis.
Safety Emery Wheel Co., Springfield, Mass.
Vitrified Wheel Co., Westfield, Mass.
Washburn Shops, Worcester, Mass.
Webster & Perks Tool Co., Springfield, O.
Wilmarth & Morman Co., Grand Rapids, Mich.

Grinding Wheels
Abrasive Material Co., Phila., Pa.
Builders' Iron Foundry, Providence, R. I.
Carborundum Co., Niagara Falls, N. Y.
Diamond Mach. Co., Provi., R. I.
Hampden Cor. Wheel Co., Brightwood, Mass.
Northampton Emery Wheel Co., Leeds, Mass.
Norton Emery Wheel Co., Worcester, Mass.
Safety Emery Wheel Co., Springfield, O.
Vitrified Wheel Co., Westfield, Mass.

Gun Barrel Machinery
Bement, Miles & Co., New York.
Diamond Mach. Co., Provi., R. I.
Niles Tool Works Co., New York.
Pond Mach. Tool Co., New York.
Reed Co., F. E., Worcester, Mass.

Hack Saw Blades and Frames
Diamond Saw & Stamping Works, Buffalo, N. Y.
Goodell-Pratt Co., Greenfield, Mass.
Starrett Co., L. S., Athol, Mass.
West Haven Mfg. Co., New Haven, Conn.

Hack Saws, Power
Diamond Saw & Stamping Works, Buffalo, N. Y.
Hoefer Mfg. Co., Freeport, Ill.

Hammers, Drop
Bement, Miles & Co., New York.
Billings & Spencer Co., Hartford, Conn.
Bliss Co., E. W., Brooklyn, N. Y.
Miner & Peck Mfg. Co., New Haven, Conn.

Hammers, Pneumatic
Chicago Pneumatic Tool Co., Chicago, Ill.
Cleveland Pneumatic Tool Co., Cleveland, O.
Daliett & Co., Thos. H., Phila., Pa.
Phila. Pneu. Tool Co., Philadelphia, Pa.

Hammers, Steam
Bement, Miles & Co., New York.
Bethlehem Fdry. & Mach. Co., So. Bethlehem, Pa.
Cleveland Punch & Shear Wks. Co., Cleveland, O.
Pittsburgh Shear Knife & Mch. Co., Pittsburgh, Pa.

Handles, Machine Tool
Schacht Mfg. Co., Cincinnati, O.

Heating Machines, Automatic
Am. Gas Furnace Co., New York.

Heating and Ventilating Apparatus
Buffalo Forge Co., Buffalo, N. Y.

Hoists, Electric
C & C Electric Co., New York.
Hunt Co., C. W., West New Brighton, N. Y.
Northern Engineering Works, Detroit, Mich.
Pawling & Harnischfeger, Milwaukee, Wis.

Hoists, Hand
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Moyer & Co., J. W., Philadel., Pa.
Yale & Towne Mfg. Co., New York.

Hoists, Pneumatic
Chicago Pneumatic Tool Co., Chicago, Ill.
Cleveland Pneumatic Tool Co., Cleveland, O.
Curtis & Co. Mfg. Co., St. Louis, Mo.
Northern Engineering Wks., Detroit, Mich.
Rand Drill Co., New York.

Hoisting and Conveying Machinery
Brown Hoisting Mchry. Co., New York.
Caldwell & Son Co., H. W., Chicago, Ill.
Hunt Co., C. W., West New Brighton, N. Y.
Link Belt Engineering Co., Philadelphia, Pa.
Moyer & Co., J. W., Philadel., Pa.
Niles-Bement-Pond Co., New York.

Indicators, Speed
Starrett Co., L. S., Athol, Mass.

Indicators, Steam
Crosby Steam Gage & Valve Co., Boston, Mass.

Inspection and Tests
Hunt Co., Robt. W., Chicago, Ill.

Injectors
Lunkenheimer Co., Cincinnati, O.
Sellers & Co., Wm., Phila., Pa.

Instruction Schools
See Schools, Correspondence.

Jacks, Hydraulic
Bethlehem Fdry. & Mch. Co., So Bethlehem, Pa.
Watson-Stillman Co., New York.

Keys, Machine
Whitney Mfg. Co., Hartford, Ct.

Key Seaters
Baker Bros., Toledo, O.
Bement, Miles & Co., New York.
Chattanooga Mchy. Co., Chattanooga, Tenn.
Davis Mach. Co., W. P., Rochester, N. Y.
Mitts & Merrill, Saginaw, Mich.

Lamps, Arc
General Electric Co., N. Y. City.
Gen. Incan. Arc Light Co., N. Y. City.
Westinghouse Elec. & Mfg. Co., Pittsburgh, Pa.

Lathe Dogs
Armstrong Bros. Tool Co., Chicago, Ill.
Besly & Co., Chas. H., Chicago, Ill.
Hill Tool Co., Anderson, Ind.
Le Count, Wm. G., So. Norwalk, Conn.
Pratt & Whitney Co., Hartford, Conn.
Schwickart, Ph., Brooklyn, N. Y.

Lathes
American Tool Wks. Co., Cin., O.
Automatic Mach. Co., Greenfield, Mass.
Auto. Mach. Co., Bridgeport, Ct.
Barker & Chard Mach. T. Co., Cincinnati, O.
Barnes Co., B. F., Rockford, Ill.
Barnes Co., W. F., & John, Rockford, Ill.
Bement, Miles & Co., New York.
Bradford Mach. Tool Co., Cin., O.
Bullard Mach. Tool Co., Bridgeport, Conn.
Davis Mach. Co., W. P., Rochester, N. Y.
Diamond Machine Co., Provi., R. I.
Fay & Scott, Dexter, Me.
Flather & Co., Nashua, N. H.
Garvin Mach. Co., New York.
Grant Tool Co., Franklin, Pa.
Greaves, Klusman & Co., Cincinnati, Ohio.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Hendey Mach. Co., Torrington, Ct.
Hill, Clarke & Co., Boston, Mass.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
McCabe, J. J., New York.
New Haven Mfg. Co., New Haven, Conn.
Niles Tool Works Co., New York.
Pond Mach. Tool Co., New York.
Pratt & Whitney Co., Hartford, Conn.
Reed Co., F. E., Worcester, Mass.
Schumacher & Boye, Cincinnati, O.
Sebastian Lathe Co., Cincin., O.
Seneca Falls Mfg. Co., Seneca Falls, N. Y.

Lathes—*Continued*
Shepard Lathe Co., Cincinnati, O.
Washburn Shops, Worcester, Mass.

Lathes, Automatic Screw-Threading
Automatic Machine Co., Bridgeport, Conn.

Lathes, Bench
Faneuil Watch Tool Co., Boston, Mass.
Waltham Watch Tool Co., Springfield, Mass.

Letters, Pattern
Butler, A. G., N. Y. City.
Racine Mchry. Co., Racine, Wis.

Levels
Starrett Co., L. S., Athol, Mass.

Lockers, Clothes
Merritt & Co., Philadelphia, Pa.

Locomotives, Shop
Hunt Co., C. W., West New Brighton, N. Y.

Lubricants
Besly & Co., Chas. H., Chicago, Ill.
Dixon Crucible Co., Jos., Jersey City, N. J.

Lubricators
Besly & Co., Chas. H., Chicago, Ill.
Bowen Mfg. Co., Auburn, N. Y.
Crane Co., Chicago, Ill.
Lunkenheimer Co., Cincinnati, O.

Machinery Builders, Special
American Fdry. & Mach. Co., Hanover, Pa.
Blanchard Mach. Co., The, Boston, Mass.
Pratt & Whitney Co., Hartford, Conn.
Simonds Mfg. Co., Pittsburgh, Pa.
Stowell, J. A., Leominster, Mass.

Machine Screws
Worcester Mach. Screw Co., Worcester, Mass.

Machinists' Small Tools
Besly & Co., Chas. H., Chicago, Ill.
Billings & Spencer Co., Hartford, Conn.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Twist Drill Co., Cleveland, O.
Crescent Instrument Works, Dubuque, Iowa.
Hammacher, Schlemmer' & Co., New York.
Patterson, Gottfried & Hunter, Ltd., New York.
Sawyer Tool Mfg. Co., Fitchburg, Mass.
Slocomb & Co., J. T., Provi., R. I.
Starrett Co., L. S., Athol, Mass.
Wyke & Co., J., E. Boston, Mass.

Measuring Machines
Rogers, John M., Boat, Gage & Drill Works, Gloucester City, N. J.

Mandrels, Expanding
Nicholson & Son, W. H., Wilkesbarre, Pa.

Mandrels, Solid
Cleveland Twist Drill Co., Cleveland, O.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Rogers, John M., Boat, Gage & Drill Works, Gloucester City, N. J.
Standard Tool Co., Cleveland, O.

Micrometer Calipers
Brown & Sharpe Mfg. Co., Providence, R. I.
Sawyer Tool Mfg. Co., Fitchburg, Mass.
Slocomb & Co., J. T., Providence, R. I.
Starrett Co., L. S., Athol, Mass.

Milling Attachments
The Adams Co., Dubuque, Iowa.
Cincinnati Milling Mach. Co., Cincinnati, O.
Kempsmith Mfg. Co., Milwaukee, Wis.
Oesterlein Mach. Co., Cincin., O.

Milling Machines, Bench
Faneuil Watch Tool Co., Boston, Mass.
Waltham Watch Tool Co., Springfield, Mass.

Milling Machines, Portable
Underwood & Co., H. B., Philadelphia, Pa.

Milling Machines, Horizontal
Adams Co., Dubuque, Iowa.
Beaman & Smith Co., Provi., R. I.
Bement, Miles & Co., New York.
Franklin Mach. Wks., Phila., Pa.
Grant Tool Wks., Franklin, Pa.
Hendey Mach. Co., Torrington, Ct.
Ingersoll Mill. Mach. Co., Rockford, Ill.
Newton Mach. Tool Wks., Philadelphia, Pa.
Niles Tool Works Co., New York.
Pratt & Whitney Co., Hartford, Conn.

Milling Machines, Plain
American Tool Wks. Co., Cin., O.
Bement, Miles & Co., New York.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mach. Co., Cincinnati, O.
Garvin Mach. Co., New York.
Hendey Mach. Co., Torrington, Ct.
Hill, Clarke & Co., Boston, Mass.
Kempsmith Mfg. Co., Milwaukee, Wis.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
Oesterlein Mach. Co., Cincin., O.
Whitney Mfg. Co., Hartford, Ct.

Milling Machines, Universal
American Tool Wks. Co., Cin., O.
Bement, Miles & Co., New York.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mach. Co., Cincinnati, O.
Garvin Mach. Co., New York.
Hendey Mach. Co., Torrington, Ct.
Hill, Clarke & Co., Boston, Mass.
Kempsmith Mfg. Co., Milwaukee, Wis.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
Niles Tool Works Co., New York.
Oesterlein Mach. Co., Cincin., O.
Waltham Watch Tool Co., Springfield, Mass.

Milling Machines, Vertical
Bement, Miles & Co., New York.
Brown & Sharpe Mfg. Co., Providence, R. I.
Garvin Mach. Co., New York.
Ingersoll Mill. Mach. Co., Rockford, Ill.
Newton Mach. Tool Wks., Philadelphia, Pa.
Niles Tool Works Co., New York.
Pratt & Whitney Co., Hartford, Conn.

Milling Tools, Adjustable
Geometric Drill Co., Westville,Ct.
Rogers, Boat, Gage & Drill Wks., John M., Gloucester City, N. J.

Molding Machines
The Adams Co., Dubuque, Iowa.
Tabor Mfg. Co., Philadelphia, Pa.
Webster & Perks Tool Co., Springfield, O.

Molds, Hammer and Vise Jaw
Field, Chas. H., Providence, R. I.

Mortising Machines, Chain
New Britain Mch. Co., New Britain, Conn.

Motors, Electric
Akron Elec. Mfg. Co., Akron, O.
C & C Electric Co., New York.
Commercial Electric Co., Indianapolis, Ind.
Crocker-Wheeler Co., Ampere, N. J.
Eck Dynamo & Motor Works, Belleville, N. J.
General Electric Co., New York.
General Incan. Arc Light Co., New York.
Jantz & Leist Elec. Co., Cin., O.
Northern Elec. Mfg. Co., Madison, Wis.
Robbins & Myers Co., Springfield, Ohio.
Roth Bros. & Co., Chicago, Ill.
Sprague Electric Co., New York.
Triumph Elec. Co., Cincinnati, O.
Westinghouse Elec. & Mfg. Co., Pittsburgh, Pa.

Name Plates
Franklin Mfg. Co., Syracuse, N. Y.
Murdock Parlor Grate Co., Boston, Mass.

Nut Tappers
See Bolt and Nut Machinery.

Oil Cups and Covers
Bay State Stamping Co., Worcester, Mass.
Besly & Co., Chas. H., Chicago, Ill.
Bowen Mfg. Co., Auburn, N. Y.
Crane Co., Chicago, Ill.
Lunkenheimer Co., Cincinnati, O.
The Winkley Co., Hartford, Conn.

Oils
Besly & Co., Chas. H., Chicago, Ill.
Houghton & Co., E. F., Philadelphia, Pa.

Packing, Metallic
U. S. Metallic Packing Co., Philadelphia, Pa.

Packing, Steam Joint
Jenkins Bros., New York.

Pans and Tote Boxes
Kilbourne & Jacobs Mfg. Co., Columbus, O.

Pans, Lathe
New Britain Mch. Co., New Britain, Conn.

Patents
Baldwin, Davidson & Wight, Washington, D. C.
Cromwell, W. H., Washington, D. C.
Cullen, Orlan Clyde, Washington, D. C.
Stevens & Co., Milo B., Washington, D. C.

Pattern Shop Machinery
American Machinery Co., Grand Rapids, Mich.
Baker Bros., Toledo, O.
Fay & Scott, Dexter, Me.
Field, Chas. H., Providence, R. I.
Greaves, Klusman & Co., Cincinnati, Ohio.

Patterns, Wood
Balkwill Pattern Works, Cleveland, Ohio.
Gobeille Pattern Co., Cleveland, O.
Lorentz & Evarts, Hartford, Conn.
Topping, J. R., Hartford, Conn.

Pipe and Fittings
Crane Co., Chicago, Ill.

Pipe Cutting and Threading Machines
Curtis & Curtis Co., Bridgeport, Conn.
Merrell Mfg. Co., Toledo, O.
Oster Mfg. Co., Cleveland, O.
Saunders' Sons, D., Yonkers, N. Y.
Wells Bros. Co., Greenfield, Mass.

Pipe Fitters' Tools
Cleveland Twist Drill Co., Cleveland, O.
Saunders' Sons, D., Yonkers, N. Y.
Standard Tool Co., Cleveland, O.

Planer, Jack
Armstrong Bros. Tool Co., Chicago, Ill.

Planers
Amer. Tool Wks. Co., Cincin., O.
Bartlett, E. E., Boston, Mass.
Belmer Mach. Tool Co., Cin., O.
Bement, Miles & Co., New York.
Betts Mach. Co., Wilmington, Del.
Cincinnati Planer Co., Cincin., O.
Detrick & Harvey Mch. Co., Baltimore, Md.
Flather Planer Co., Mark, Nashua, N. H.
Garvin Mach. Co., New York.
Gray Co., G. A., Cincinnati, O.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Hendey Mach. Co., Torrington, Ct.
Hill, Clarke & Co., Boston, Mass.
Niles Tool Works Co., New York.
New Haven Mfg. Co., New Haven, Conn.
Pond Mach. Tool Co., New York.
Sellers & Co., Wm., Phila., Pa.
Whitcomb Mfg. Co., Worcester, Mass.
Woodward & Powell Planer Co., Worcester, Mass.

Planers, Portable
Morton Mfg. Co., Muskegon Heights, Mich.
Underwood & Co., H. B., Philadelphia, Pa.

Planers, Rotary
Bement, Miles & Co., New York.
Cleveland Punch & Shear Works, Cleveland, O.
Franklin Mach. Wks., Phila., Pa.
Newton Mch. Tool Works, Philadelphia, Pa.
Pond Mach. Tool Co., New York.
Underwood & Co.,H. B., Phila., Pa.

Presses, Power
Automatic Mach. Co., Bridgeport, Conn.
Bethlehem Fdry. & Mch. Co., So. Bethlehem, Pa.
Bliss Co., E. W., Brooklyn, N. Y.
Dill Mach. Works, T. C., Philadelphia, Pa.
Mossberg & Granville Mfg. Co., Providence, R. I.

Presses, Hydraulic
Bement, Miles & Co., New York.
Watson-Stillman Co., New York.

Profilers
Garvin Mach. Co., New York.
Pratt & Whitney Co., Hartford, Conn.

Pulley Turning and Boring Machines
Harrington, Son & Co., Edwin, Philadelphia, Pa.
New Haven Mfg. Co., New Haven, Conn.
Niles Tool Works Co., New York.

Pulleys
American Pulley Co., Phila., Pa.
Cresson Co., Geo. V., Philadel., Pa.
Howard Iron Works, Buffalo, N. Y.
Jones Fdry. & Mch. Co., W. A., Chicago, Ill.
Poole & Son Co., Robt., Baltimore, Md.
Reeves Pulley Co., Columbus, Ind.

Pulleys, Friction Cone
Evans Friction Cone Co., Boston, Mass.

Pumps, Hydraulic
Watson-Stillman Co., New York.

Punches, Hydraulic
Bement, Miles & Co., New York.
Bethlehem Fdry. & Mch. Co., So. Bethlehem, Pa.
Watson-Stillman Co., New York.

Punches, Power
Bliss Co., E. W., Brooklyn, N. Y.
Bremer Mach. & Tool Co., Kalamazoo, Mich.
Buffalo Forge Co., Buffalo, N. Y.
Cleveland Punch & Shear Wks., Cleveland, O.
Hilles & Jones Co., Wilmington, Del.
Long & Allstatter Co., Hamilton, Ohio.
Pittsburgh Shear Knife & Mch. Co., Pittsburgh, Pa.
Reade Mchry Co., Cleveland, O.

Rack Cutting Machines
Fellows Gear Shaper Co., Springfield, Vt.
Gould & Eberhardt, Newark, N. J.
Le Belond Mach. Tool Co., R. K., Cincinnati, O.
Reed Co., F. E., Worcester, Mass.

Racks, Cut
Fellows Gear Shaper Co., Springfield, Vt.
Nuttall Co., R. D., Pittsburgh, Pa.
Simonds Mfg. Co., Pittsburgh, Pa.
Van Dorn & Dutton Co., Cleve., O.

Racks, Tool
New Britain Mach. Co., New Britain, Conn.

Reamers
Chadwick & Co., J. B., Portmouth, N. H.
Cleveland Twist Drill Co., Cleveland, O.
Clough, R. M., Tolland, Conn.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt & Whitney Co., Hartford, Conn.
Rogers, John M., Boat, Gage & Drill Works, Gloucester City, N. J.
Standard Tool Co., Cleveland, O.
Wells Bros. Co., Greenfield, Mass.

Reaming Stands
Flather Planer Co., Mark, Nashua, N. H.

Rheostats
General Incan. Arc Light Co., New York.

Roller and Ball Bearings
American Roller Bearing Co., Boston, Mass.
Ball Bearing Co., Philadel., Pa.
Mossberg & Granville Mfg. Co., Providence, R. I.
Roller Bearing & Equipment Co., Keene, N. H.

Riveters, Hydraulic
Bement, Miles & Co., New York.
Watson-Stillman Co., New York.

Riveters, Pneumatic
Bement, Miles & Co., New York.
Cleveland Pneumatic Tool Co., Cleveland, O.
Philadelphia Pneumatic Tool Co., Philadelphia, Pa.

Riveting Machines
Bement, Miles & Co., New York.
Bethlehem Foundry & Mach. Co., So. Bethlehem, Pa.
Long & Allstatter Co., Hamilton, Ohio.

Rolling Mill Machinery
Cleveland Punch & Shear Wks. Co., Cleveland, O.
Diamond Drill & Mch. Co., Birdsboro, Pa.
Dill Mach. Works, T. C., Philadelphia, Pa.
Hilles & Jones Co., Wilmington, Del.
Mossberg & Granville Mfg. Co., Providence, R. I.
Pratt & Whitney Co., Hartford, Conn.

Safety Valves Pop
Crane Co., Chicago, Ill.
Crosby Steam Gage & Valve Co., Boston, Mass.
Lunkenheimer Co., Cincinnati, O.

Sawing Machines, Metal
Cleveland Punch & Shear Works Co., Cleveland, O.
Newton Mach. Tool Works, Philadelphia, Pa.
Pratt & Whitney Co., Hartford, Conn.
Reade Mchry. Co., Cleveland, O.

Schools, Correspondence
Amer. School of Correspondence, Boston, Mass.
Consolidated Schools, N. Y. City.
International Correspond. Schools, Scranton, Pa.

Schools, Technical
Mich. College of Mines, Houghton, Mich.
Pratt Institute, Brooklyn, N. Y.

Screw Machines, Automatic
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Machine Screw Co., Cleveland, Ohio.
Dreses Mach. Tool Co., Cincin., O.
Windsor Mach. Co., Windsor, Vt.

Screw Machines, Hand
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Mch. Screw Co., Cleveland, O.
Garvin Mach. Co., New York.
Jones & Lamson Mch. Co., Springfield, Vt.
Pearson Mach. Co., Chicago, Ill.
Potter & Johnston Mach. Co., Pawtucket, R. I.
Pratt & Whitney Co., Hartford, Conn.
Warner & Swasey Co., Cleveland, Ohio.
Windsor Mach. Co., Windsor, Vt.

Screw Machinery, Wood and Lag
Baker Bros., Toledo, Ohio.
Cook Co., Asa S., Hartford, Conn.

Screw Plates
Besly & Co., Chas. H., Chicago, Ill.
Carpenter Tap & Die Co., J. M., Pawtucket, R. I.
Card Mfg. Co., S. W., Mansfield, Mass.
Hart Mfg. Co., Cleveland, O.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Oster Mfg. Co., Cleveland, O.
Wells Bros. Co., Greenfield, Mass.
Wiley & Russell Mfg. Co., Greenfield, Mass.

Second Hand Machinery
Baird Machy. Co., U., Pittsburgh, Pa.
Bowler & Co., Geo. H., Cleveland, Ohio.
Carlin Mchry. & Supply Co., Allegeny, Pa.
Chicago House Wrecking Co., Chicago, Ill.
Dawson, John H., Chicago, Ill.
Fairbanks Co., New York.
Fairbanks Co., Philadelphia, Pa.
Garvin Mch. Co., New York.
Hall's Sons, Sam'l, New York.
Hill, Clarke & Co., Boston, Mass.
Marshall & Huschart Mchry. Co., Chicago, Ill.
McCabe, J. J., New York.
Niles Tool Works Co., New York.
Osborn Mchry. Co., New Haven, Conn.
Pratt & Whitney Co., Hartford, Conn.
Prentiss Tool & Supply Co., New York.
Toomey, Frank, Philadelphia, Pa.
Wormer Machy. Co., C. C., Detroit, Mich.

Separators, Magnetic
American Tool & Mach. Co., Boston, Mass.
Springfield Separator Co., Springfield, Vt.

Shafts, Flexible
Chicago Flexible Shaft Co., Chicago, Ill.

Shapers
Amer. Tool Wks. Co., Cincin., O.
Bement, Miles & Co., New York.
Cincinnati Shaper Co., Cincin., O.
Flather Planer Co., Mark, Nashua, N. H.
Garvin Mach. Co., New York.
Hendey Mach. Co., Torrington, Ct.
Gould & Eberhardt, Newark, N. J.
Hill, Clarke & Co., Boston, Mass.
Kelly Co., R. A., Xenia, Ohio.
Morton Mfg. Co., Muskegon Heights, Mich.
New Haven Mfg. Co., New Haven, Conn.
Niles Tool Works Co., New York.
Potter & Johnston Mach. Co., Pawtucket, R. I.
Steptoe & Co., John, Cincinnati, O.

Shears, Power
Bethlehem Fdry. & Mch. Co., So. Bethlehem, Pa.
Bliss Co., E. W., Brooklyn, N. Y.
Bremer Mach. & Tool Co., Kalamazoo, Mich.
Buffalo Forge Co., Buffalo, N. Y.
Cleveland Punch & Shear Works, Cleveland, O.
Hilles & Jones Co., Wilmington, Del.
Long & Allstatter Co., Hamilton, Ohio.
Pittsburgh Shear Knife & Mch. Co., Pittsburgh, Pa.
Reade Mchry. Co., Cleveland, O.

Shears, Rotary
Bethlehem Foundry & Mach. Co., So. Bethlehem, Pa.
Detrick & Harvey Mach. Co., Baltimore, Md.

Shelving, Shop
New Britain Mach. Co., New Britain, Conn.

Slide Rests
Bartlett Co., E. E., Boston, Mass.
Reed Co., F. E., Worcester, Mass.

Slotters
Baker Bros., Toledo, Ohio.
Bement, Miles & Co., New York
Betts Mach. Wks., Phila., Pa.
Dill Mach. Wks., T. C., Phila., Pa.
Franklin Mach. Wks., Phila., Pa.
Garvin Mach. Co., New York.
New Haven Mfg. Co., New Haven, Conn.
Newton Mach. Tool Wks., Philadelphia, Pa.
Niles Tool Works Co., New York.

Speed Limit System
Consolidated Engine Stop Co., New York.

Springs
Cleveland Wire Spring Co., Cleveland, O.

Sprocket Chains
See Driving Chains.

Stamps, Letters and Figures
Schwerdtle Stamp Co., Bridgeport, Conn.

Stampings, Sheet Steel
Automobile & Cycle Parts Co., Cleveland, O.

Steel, Machinery
International Steel & Mchry. Co., New York.
Patriarche & Bell, New York.
Ward & Son, Edgar T., Boston, Mass.

Steel, Sheet
Automobile & Cycle Parts Co., Cleveland, O.
Ward & Son, Edgar T., Boston, Mass.
Westmoreland Steel Co., Pittsburgh, Pa.

Steel, Tool
International Steel & Mach. Co., New York.
Patriarche & Bell, New York.

Straightener, Hydraulic
Bement, Miles & Co., New York.
Watson-Stillman Co., New York.

Straightener, Screw
Towsley Mfg. Co., John T., Cincinnati, O.

Swaging Machines
Excelsior Needle Co., Torrington, Conn.

Switchboards
C & C Electric Co., New York.
Triumph Elec. Co., Cincinnati, O.

Taps, Collapsing
Geometric Drill Co., Westville, Ct.

Tapping Machines and Attachments
Baker Bros., Toledo, O.
The Beaman & Smith Co., Providence, R. I.
Bickford Drill & Tool Co., Cin., O.
Cincinnati Mach. Tool Co., Cincinnati, O.
Errington, F. A., N. Y. City.
Fosdick & Holloway Mach. Tool Co., Cincinnati, O.
Garvin Mach. Co., New York.
Geometric Drill Co., New York.
Geometric Drill Co., Westville, Ct.
Gould & Eberhardt, Newark, N. J.
Pratt & Whitney Co., Hartford, Conn.
Seneca Falls Mfg. Co., Seneca Falls, N. Y.
Webster & Perks Tool Co., Springfield, O.

Taps and Dies
Besly & Co., Chas. H., Chicago, Ill.
Card Mfg. Co., S. W., Mansfield, Mass.
Carpenter Tap & Die Co., J. M., Pawtucket, R. I.
Cleveland Twist Drill Co., Cleveland, O.
Crane Co., Chicago, Ill.
Hammacher, Schlemmer & Co., New York.
Hart Mfg. Co., Cleveland, O.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Oster Mfg. Co., Cleveland, Ohio.
Pratt & Whitney Co., Hartford, Conn.
Standard Tool Co., Cleveland, O.
Wells Bros. Co., Greenfield, Mass.
Wiley & Russell Mfg. Co., Greenfield, Mass.

Telephone System
Clarke Auto. Telephone Switch Board Co., Providence, R. I.

Threading Dies, Opening
Errington, F. A., New York.
Geometric Drill Co., Westville, Ct.
Jones & Lamson Mch. Co., Springfield, Vt.
Pratt & Whitney Co., Hartford, Conn.

Thread Cutting Tools
Besly & Co., Chas. H., Chicago, Ill.
Hart Mfg. Co., The, Cleveland, O.
Oster Mfg. Co., Cleveland, Ohio.
Pratt & Whitney Co., Hartford, Conn.
Rivett-Dock Co., Boston, Mass.

Tool Holders
Armstrong Bros. Tool Co., Chicago, Ill.
Hill Tool Co., Anderson, Ind.

Tools
See Machinists' Small Tools.

Transmission Machinery
Allston Fdry. Co., Boston, Mass.
American Pulley Co., Phila., Pa.
Caldwell & Son Co., H. W., Chicago, Ill.
Cresson & Co., Geo. V., Phila., Pa.
Jones Fdry. & Mch. Co., W. A., Chicago, Ill.
Link-Belt Engineering Co., Philadelphia, Pa.
Patterson, Gottfried & Hunter, Ltd., New York.
Reeves Pulley Co., Columbus, Ind.

Traps, Steam
Houghton & Co., E. F., Philadelphia, Pa.

Trolleys and Tramways
Brown Hoisting Machy. Co., N. Y. City.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Hunt Co., C. W., West New Brighton, N. Y.
Link Belt Engineering Co., Philadelphia, Pa.
Maris Bros., Philadelphia, Pa.
Moyer & Co., J. W., Philadel., Pa.
Yale & Towne Mfg. Co., New York.

Trucks, Shop
Towsley Mfg. Co., John T., Cincinnati, O.

Trimmers, Wood
Amer. Mchry. Co., Grand Rapids, Mich.
Leland & Faulconer Mfg. Co., Detroit, Mich.
Washburn Shops, Worcester, Mass.

Turrets, Carriage
Fay & Scott, Dexter, Me.

Turret Machines
American Tool & Mach. Co., Boston, Mass.
Automatic Mach. Co., Greenfield, Mass.
Barker & Chard M. T. Co., Cin., O.
Bradford Mach. Tool Co., Cincinnati, O.
Brown & Sharpe Mfg. Co., Providence, R. I.
Bullard Mach. Tool Co., Bridgeport, Conn.
Cleveland Mach. Screw Co., Cleveland, O.
Dreses Mach. Tool Co., Cincin., O.
Flather & Co., Nashua, N. H.
Garvin Mach. Co., New York.
Gisholt Mch. Co., Madison, Wis.
Grant Tool Co., Franklin, Pa.
Hill, Clarke & Co., Boston, Mass.
Jones & Lamson Mch. Co., Springfield, Vt.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
Lodge & Shipley Mach. Tool Co., Cincinnati, O.
Niles Tool Works Co., New York.
Pearson Mach. Co., Chicago, Ill.
Potter & Johnston Mach. Co., Pawtucket, R. I.
Warner & Swasey Co., Cleveland, Ohio.
Windsor Mach. Co., Windsor, Vt.

Twist Drills
Cleveland Twist Drill Co., Cleveland, O.
Etna Mfg. Co., New York.
Hammacher, Schlemmer & Co., New York.
Morse Twist Drill & M. Co., New Bedford, Mass.
Standard Tool Co., Cleveland, O.

Universal Joints
Baush Machine Tool Co., Springfield, Mass.
Gray & Prior Mach. Co., Hartford, Conn.

Valves
See Steam Fittings.

Vises, Metal Workers'
Hammacher Schlemmer & Co., New York.
Howard Iron Works, Buffalo, N. Y.
Parker Co., Chas., Meriden, Conn.
Walworth Mfg. Co., Boston, Mass.

Vises, Pipe
Curtis & Curtis Co., Bridgeport, Conn.
Saunders' Sons, D., Yonkers, N. Y.
Walworth Mfg. Co., Boston, Mass.

Vises, Planer and Shaper
Cincinnati Planer Co., Cincin., O.
Hendey Mach. Co., Torrington, Ct.
Pratt & Whitney Co., Hartford, Conn.

Vises, Wood Workers'
Hammacher, Schlemmer & Co., New York.
Wyman & Gordon, Worcester, Mass.

Welding Machines
Long & Allstatter Co., Hamilton, Ohio.

Wire-Forming Machinery
Automatic Mach. Co., Bridgeport, Conn.
Mossberg & Granville Mfg. Co., Providence, R. I.

Worm Hobbing Machines
Grant Tool Wks., Franklin, Pa.
Pratt & Whitney Co., Hartford, Conn.

Worm Milling Machines
Cleveland Mach. Screw Co., Cleveland, O.
Pratt & Whitney Co., Hartford, Conn.

Wrenches
Coes Wrench Co., Worcester, Mass.

Wrenches, Drop Forged
Billings & Spencer Co., Hartford, Conn.
Williams & Co., J. H., Brooklyn, N. Y.

Circular Planing Attachment..

No doubt many machinists have wondered, when looking at a mangle at work in a laundry, how the steam chest was

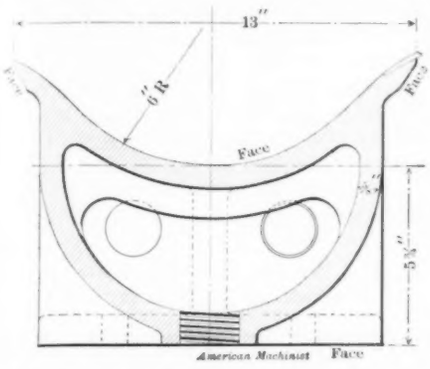


FIG. 1. SECTION THROUGH STEAM-CHEST.

machined to fit the ironing roller. Fig. 1 shows a section through a steam chest. These chests are from 8 to 10 feet long and are made of very close grained hard iron, as they must be absolutely steam-tight. Fig. 2 shows a planer with a simple device for planing a true circle fitted to each head, so that two chests can be planed at once side by side.

The swivel bolt in clapper box or apron, which is usually near the bottom, is moved up, so that when swinging on this center the bottom of tool block will clear the rough casting on either side when tool is cutting. The top of the clapper box is made extra wide and hobbed out; above this on each of the slides is fitted a bracket carrying the worm and feed shaft. Gears *a* are tight on the worm shaft; above are the slip gears *b* on the feed shaft, which

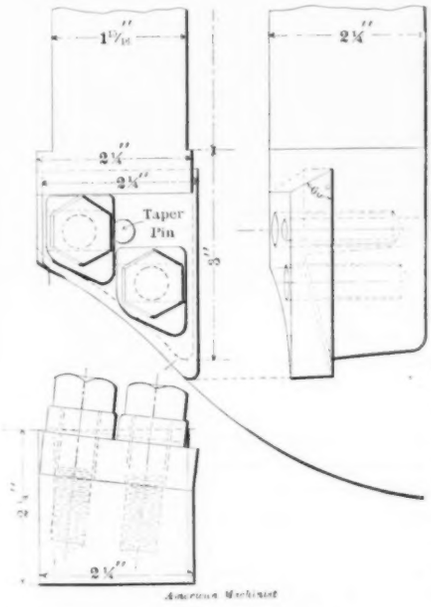


FIG. 3. TOOL FOR PLANING STEAM-CHESTS.

is splined the entire length, so that either head may be engaged or disengaged separately; the feed shaft is squared on the end, similar to the rail screws, and the same crank handle can be used to feed either head by hand for testing or starting the cut. Between the heads and also between right-hand head and bracket at end of rail are fitted two universal joints, so that one tool can be fed down in advance of the other; this is necessary on account of the roughness of the castings. Gages are provided for setting the tools the proper distance from center for the required radius.

Above the plain feed gear at end of rail a stud is fitted, carrying the ratchet feed gear *c* by means of which the tools can be fed in either direction; this ratchet gear also carries a sprocket wheel from which the feed is transmitted to feed shaft by a Renolds chain. *d* is a swinging arm supporting the shaft and swiveling on the ratchet gear stud; as this arm is held in place by a cap screw through a slot, it can be adjusted to any desired position. All these parts are so fitted as to require only a few moments to change from circular planing to the regular planer work. The feed shaft can be removed by taking out two taper pins; the worm can be disengaged by withdrawing the two taper dowel pins; these pins all being fitted with nuts, for drawing them out. The bolt holes are slotted so that gear bracket may be raised; then by putting into hole *f* the regular tightener for clapper box the machine can be used on regular work without any inconvenience.

In machining these steam chests the bottom is planed first, then they are turned over and one placed over each tee slot in the table for convenience in clamping. The outer flange (called the apron) shown at *A*, Fig. 1, is then rough planed to take off all the scale; next the circular part is planed, the tools being set to the gage; the cut is started in the center to the proper depth and then fed in a circle to

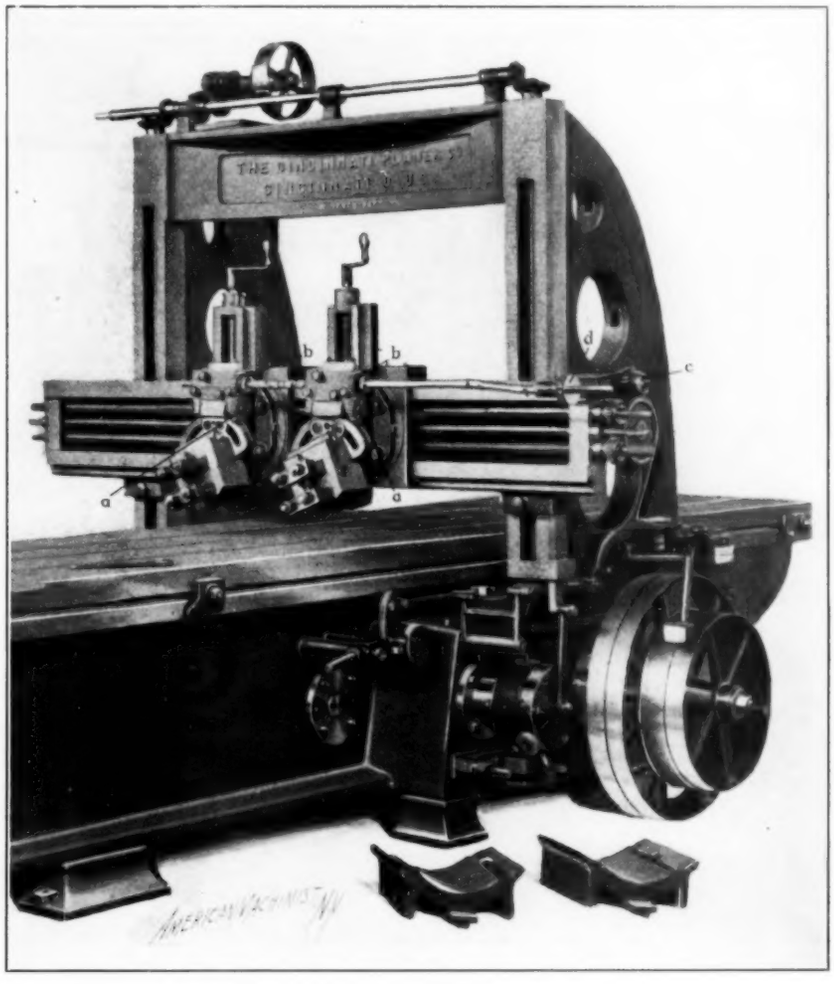


FIG. 2. CIRCULAR PLANING ATTACHMENT.

the outer edge. For finishing, a wide tool ground to the required radius is used, so that a wide finishing cut can be taken, the same as on flat surface work; after that the outer flange or apron is finished with forming tools as shown in Fig. 3. The cutters are set at an angle so as to take a shearing cut.

The machine is a regular 36-inch planer, made to take in 52 inches in width; this width being necessary for handling the side frames of the mangle. The planer with circular attachment was built by the Cincinnati Planer Company, Cincinnati, Ohio.

Ring Turret Lathe.

The accompanying illustrations show a turret lathe built for Mr. Walter H. Foster, 136 Liberty street, New York. It will be noticed that the machine has a number of novel features—the most interesting one being the turret which is made in the form of a ring and encircles the bed.

The half-tone, Fig. 1, gives a good idea of the machine, although a few changes in design have been made since this photograph was taken. The bed and head are now made in one casting instead of separately, as shown, and the gearing at the end of head is enclosed. Fig. 2 shows the construction of the head, spindle and chuck so clearly that little description of these parts is necessary.

The spindle, which is bored out to take stock 2½ inches in diameter, runs in self-oiling bearings, is driven by a three-step cone and is back geared; a lever in front throwing in either the direct or the back-gear friction. The chuck is operated by a toggle, and the throwing over of the lever to open the chuck starts the roller feed at the rear end of the spindle, the stock feeding through to a stop. The bell crank in front operated by the chucking lever is connected by a reach rod with an arm or lever at the rear end of the head. This arm moves the sliding ring mounted at the end of the spindle and throws in the roller feed gear. A stiff spring on the reach rod draws it back when the chuck is closed, and the feed gear is then disconnected. The feed rollers are adjusted for different sizes by means of the two square head screws shown just back of the sliding ring.

The gear box at the left of the head carries a nest of gears for driving the feed rod for the turret slide or carriage. These gears are driven by the pulley mounted at the left and belted from a pulley on the end of the spindle. The feed is changed by moving the lever at the right of the gear box.

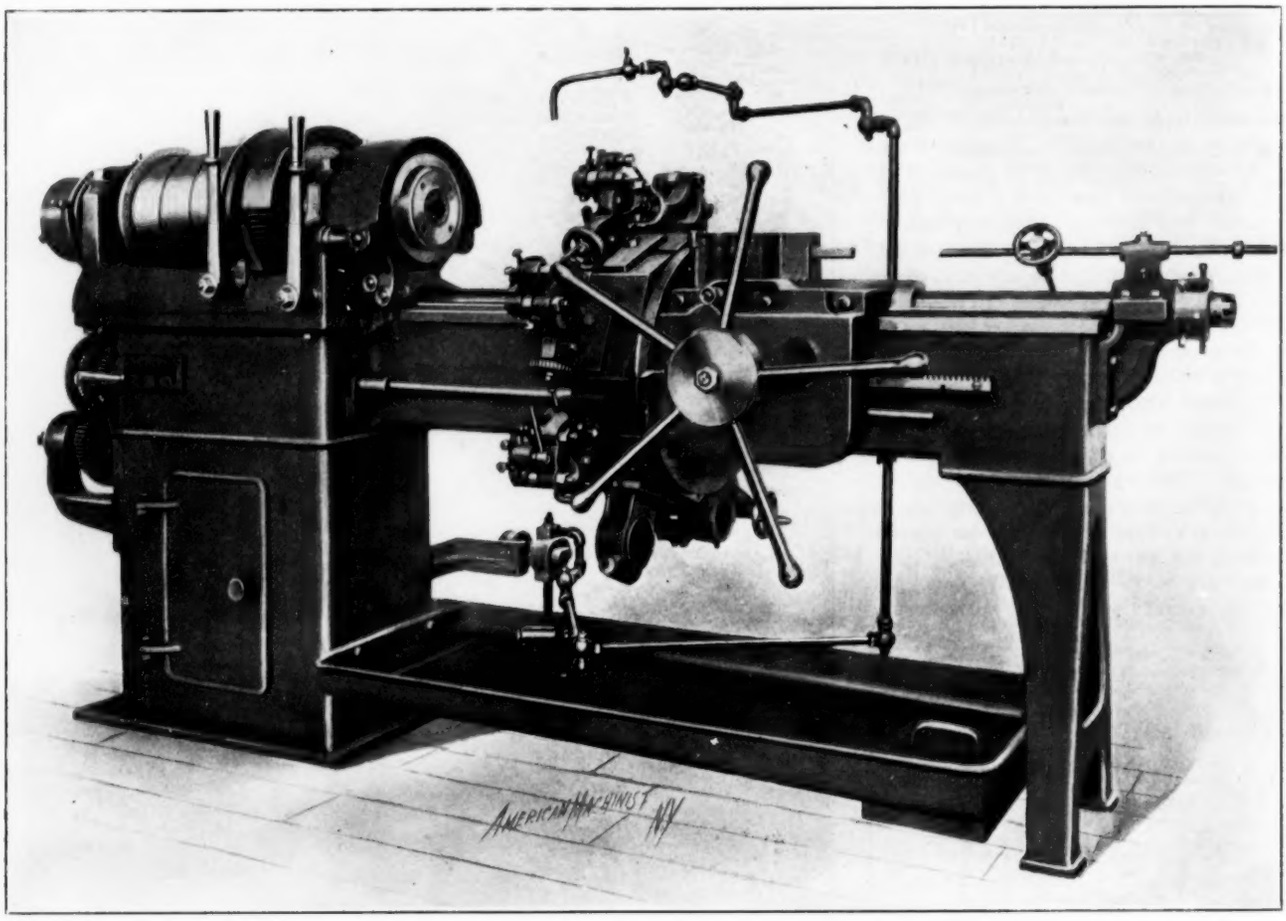


FIG. 1. RING TURRET LATHE.

Figs. 3, 4 and 5 show plan, front and end views of the carriage and its turret, Fig. 5 showing also a section through the bed. The feeding mechanism for the carriage is shown dotted in behind the apron in Fig. 4. The splined feed rod driven by the gearing at the end of the bed carries a gear mounted in the apron directly back of and meshing with spur gear *A*. On the hub of gear *A* is a worm driving worm wheel *B*. The gear and worm are carried in a bracket which can be dropped out of the way or swung up into place by moving the lever *C*. The handle *G* at the top of this lever is provided with a catch which holds the lever back to the right and keeps the worm in mesh with the worm wheel. When this catch is released either by hand or automatically the worm swings down away from the wheel. Back of the worm wheel and turning with it is a pinion that can be connected with gear *F* by means of the reversing gears carried on the arm *D*. Gear *F* drives a shaft carrying on its inner end a pinion meshing with the rack on the front of the bed; and as *F* can be driven in either direction by means of the two gears on arm *D*, the carriage can of course be fed either toward or away from the spindle. The reversing arm *D* is operated by the crank *E*—the crank being lifted or dropped according to the direction in which the carriage is to be fed. The usual pilot wheel is employed for the hand feed.

Fig. 3 gives a good idea of the shape of the turret and Fig. 4 shows the manner in which it is mounted on the carriage. The turret is bored out at an angle from each side, fits on a conical seat and is held back in place by means of a ring carried at the front. By means of this ring any play between the turret and its bearing may be taken up. The turret has eight sides and can carry as many tools—grooves being planed across and holes tapped for locating and fastening the tool-holders. The locking bolt *J* enters steel bushings fitted into the back of the turret. One of these bushings is shown near the

the top of the turret in Fig. 4. The lock bolt is square in section and milled down at the front end, one side being cut parallel and the other at an angle with the side of the body. The bolt is shown in plan in Fig. 3, which also shows the two taper gibs between which it slides. The bolt is withdrawn from the turret by means of the bent lever K which is operated by the taper piece N, mounted on and moving with the bar M. As the carriage is run back along the bed, this bar M—which is provided with a stiff spring to throw it well out—strikes an adjustable stop rod clamped as seen in Fig. 1 at the end of the machine. The taper piece N strikes the projection on lever K, swinging the lever back and thus drawing out the lock bolt. A trigger L catches the inner end of the bent lever, as it swings around and the bolt cannot slide back until the lever is released. In the back side of the turret are eight round-head screws or studs—one for each tool. These screws can be adjusted in and out and clamped in place by small binding screws. One of these screws can be seen near the outside of turret in Fig. 4, and it will be noticed

The driving shaft for this mechanism is mounted in a bracket bolted fast to the head and on the end of the shaft is keyed a friction plate W. The outer end of the bracket is turned up to form a bearing for the driving pulley P, and this bearing is long enough to allow the pulley considerable end movement. The inside of the pulley rim is bored out to conform to the taper of the friction W mounted on the driving shaft. The other end of this shaft carries a pinion meshing with a gear R mounted on a stud in the bracket. The driving pulley P is belted from the countershaft. As the carriage is run back along the bed of the machine the end of the lever which withdraws the locking

allows rod U to move toward the head, throwing over the lever and disconnecting the driving pulley.

The shaft which runs through pinion O and drives the turret extends the entire length of the machine—the outer end being mounted in a bracket at the end of the bed. This shaft has eight grooves, in which fit the carriage stops. In Fig. 1 the shaft is shown projecting through the bracket and carrying a collar with set-screws for clamping the stops in place. As this shaft revolves to bring the turret into position the proper stop is brought in line with the arm H, Fig. 3, and as this arm comes to the end of the stop it is swung around and operates the

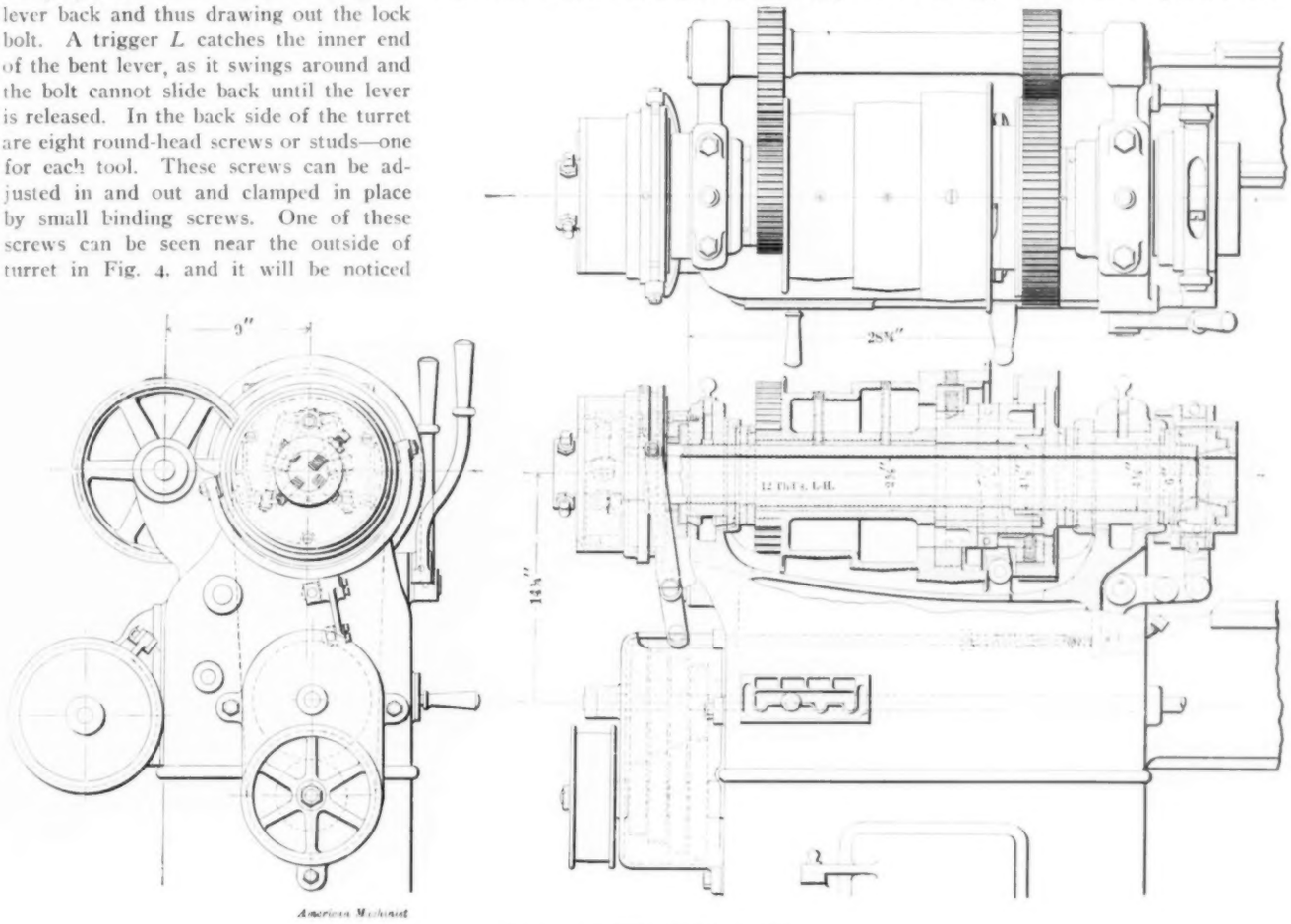


FIG. 2. TURRET LATHE HEAD.

that its head comes in contact with the trigger that holds lever K and lock bolt back. As the turret revolves these screws, striking the trigger, release the bolt. If the operator wishes to skip one, two or any number of index holes he has only to screw in the corresponding knock-off screw until their heads are flush with the back of turret. The screw will then pass without striking the trigger and the bolt will be held back. The inside of the turret is made to form an internal gear and meshing with this gear is the pinion O. This pinion is fitted with a feather and is rotated by a splined shaft connected with the mechanism carried at the back of the head and shown in Figs. 6 and 7.

bolt from the turret depresses the spring plunger G, Fig. 7. This plunger strikes an adjustable collar on the reach rod V and the rod moving the lever at the end of the head, throwing the pulley P against disk W, the driving shaft and gear R are set in motion. As gear R rotates, pins driven in its hub enter slots in the face of gear S and turn it through a part of a rotation. This gear as it turns drives the shaft that rotates the turret. By means of this mechanism the turret is started slowly, turns with a gradually increasing and then decreasing speed, and comes to rest as the lock bolt slides into place. When the lever which holds back the lock bolt is released, the plunger Q lifts and

knock-off in lever C, Fig. 4, throwing out the feed.

The tools being carried on the outside of the turret, each tool has considerable space; in fact, a good sized fixture can be put on without in any way interfering with the tools at either side. The tools will turn in one operation a length of 28 inches, but as there is nothing whatever back of the turning tool to interfere with the work the bar can project through as far as desired and work of considerable length can be handled. The arrangement of the tools can be seen in the half-tone, and it will be noticed that the cutting tool is carried at right angles to the bottom of the holder, and is therefore parallel to a line

through the center of spindle and turret. The turret being mounted on a large bearing and the tool carried in the manner noted there is practically no tendency whatever for the turret to move when the tool is cutting. In fact, for a reason which will be apparent upon a little reflection, the tendency when cutting is for the work itself to center and hold the tool in place.

The back rests for the turning tool, after being once adjusted properly, can be removed if desired and put back in place without readjusting; the rests being held in position by a device at the back of the holder operated by the small lever at the top. A taper turning attachment is made for the machine, but is not shown in the half-tone. The dimension of the turret faces and the distance from same to the spindle center are such that the Jones & Lamson tools can be used if desired.

The turret is practically self-cleaning, for, as it turns, the chips and oil will drop off into the pan below. A semi-circular guard is carried beneath the turret when the machine is in operation; this guard being removed when the photograph was taken in order that the turret and tools might be shown more clearly.

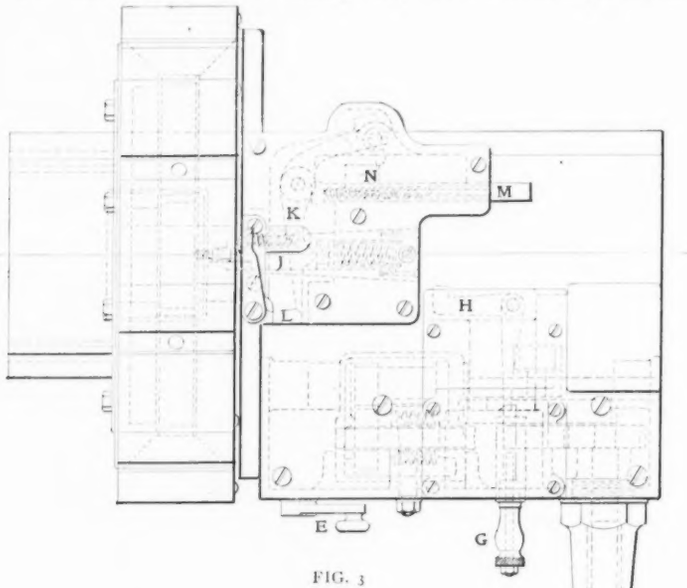
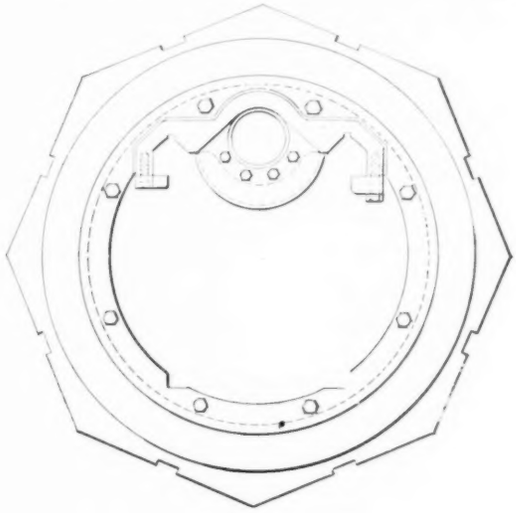


FIG. 3



Turret

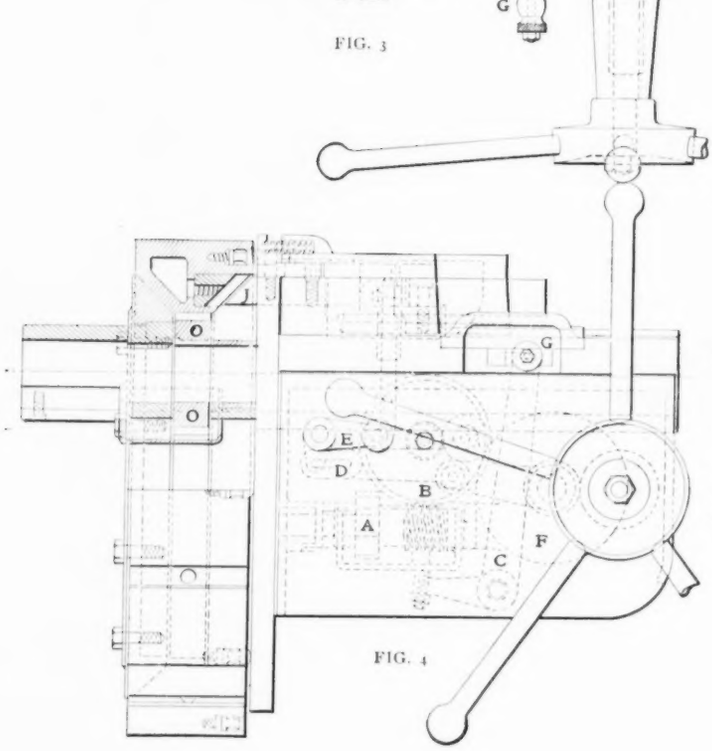


FIG. 4

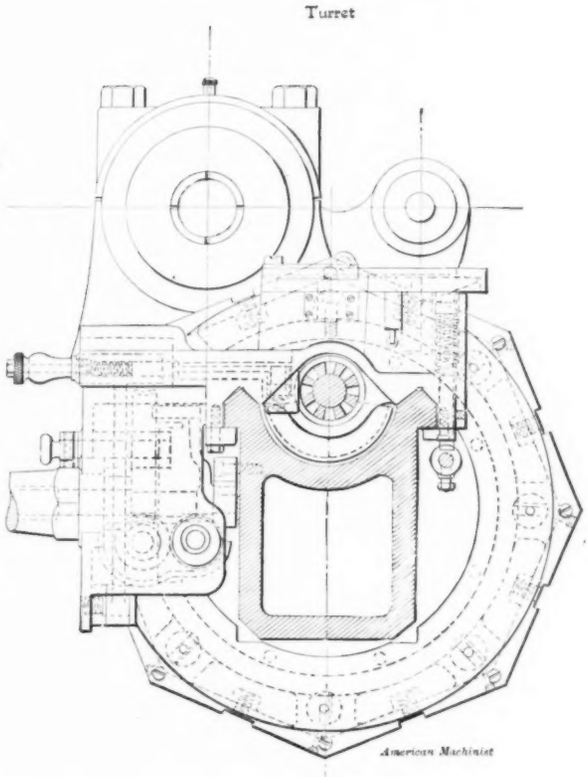


FIG. 5

CARRIAGE AND TURRET.

The countershaft for this machine has two forward speeds and one reverse. It should run forward at 80 and 160 turns and back at 180 turns per minute.

Power at the St. Louis Exposition.

It is stated that several times the power employed at any previous exposition will be used at the Louisiana Exposition. Present estimates place the amount at 22,000 horse-power. The Director of Exhibits says, in part: "Letters have been addressed to exhibitors in machinery at previous expositions requesting an expression of their willingness to participate, and the replies, in the highest degree satisfactory, indicate that practically all desire to exhibit at St. Louis, but on a much larger scale. A circular of instructions is being prepared. It will reach not only the makers of machinery and machine appliances but also those interested in the machinery trade, it being the purpose to create a widespread interest and a sentiment favorable to the Exposition. The Chief, in his contact with machinery people, finds that the granting of free power and space appeals not only to exhibitors but to the

general public in a forceful way. He reports: 'The people see that we are not asking for National and State appropriations, and then exacting fees from the very class for the special benefit of whom the Exposition professes to organize and theoretically to exist.'"

The Relative Position of Employer and Employed.*

"Masters give unto your servants that which is just and equal."

"Servants obey in all things your masters according to the flesh, not with eye-service as men-pleasers, but in singleness of heart."

According to this authority it will be seen that the interests of employer and employed are co-equal. Although it has been often asserted that the rights of the employer and the employed are in direct antagonism, and from the nature of things this must often appear so, it does not follow that they must be hostile, as each individual has to earn his living and a living for his family, whether he be an employer or be employed. The employee desires to sell his labor in the highest market, and the employer wishes to buy his labor in the lowest market; it is simply each individual trying to secure the best bargain. Yet withal their interests are to a certain extent mutual, as the employer's success depends upon the capability and physical condition of his workmen, and the workman depends upon the success and financial condition of his employer so as to sell his labor and secure a living.

The question arises, what are "wages"? The answer is very simple and must be settled upon the principles of equity, as the employer who takes labor from anyone without just recompense is guilty of theft, and similarly a laborer who takes wages from any individual, a company or a state, without giving value received, is guilty of the same crime. This is a natural conclusion and cannot be otherwise, for if there were no correct system of wages there would be no impetus for work. If the state owed us our living and gave it to us, we would be encouraged to indolence. But the state does not owe anyone his living. It simply owes to him the condition whereby he can earn his living, and no individual has the right to get his living from anyone except through his physical or mental labors. Now with these conditions existing, two classes are naturally evolved—employers and employed. As the interests of the two parties are co-equal, it would seem necessary that an agreement be reached wherein both parties may get along in harmony and not infringe upon each other's rights. This agreement can best be reached by the organization of both employers and employed, but not with the object of compelling either party to submit to any arbitrary demands and leading to lockouts or strikes, which are productive only of injury to all concerned and are a menace to social order and good government.

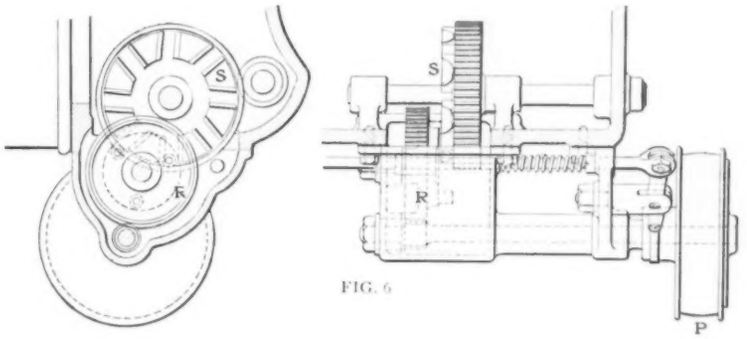


FIG. 6

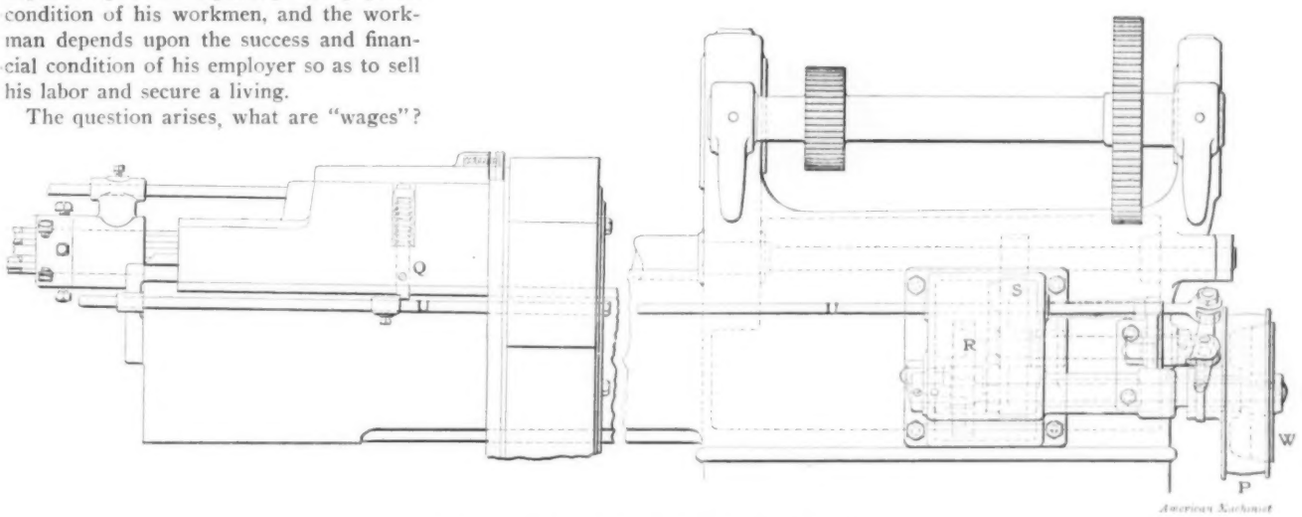


FIG. 7. MECHANISM FOR TURNING TURRET.

The first trade union was formed in England about the middle of the eighteenth century. It was then formed as a necessity on account of the alarming degradation existing among the working classes, the object of trades unions being to improve and protect the interests of the workmen, and in particular to raise the rate of wages. Some political economists have maintained that this is impossible, as only a certain amount of capital is laid aside to be paid in wages. If labor is plentiful the divisor will be all the larger, and consequently the individual laborer will receive less. If labor is scare the divisor will be smaller, which will give him all the more. This is a mistaken idea, as labor is paid from what is produced and capital advances to labor its share knowing that it will be returned when the product is sold. Labor is simply a commodity which is bought and sold, but with this difference, that the seller of a manufactured commodity can withhold the sale of the article if the price is too low, but when the laborer puts his labor upon the market he must sell it, as it is the only means whereby he can live. He as an individual offering his labor for sale is compelled to take just whatever the market may offer, and consequently there may be reductions of wages which will bring cut-throat competition and general demoralization to employer and employed.

Trades unions in the past have in a great many cases been very arbitrary. They have tried to compel employers to submit to very unreasonable demands, and have generally suffered therefor themselves. The true and only method whereby the trade union can raise wages is to increase the amount and efficiency of the product.

Restriction of the amount of work is wrong morally and ethically, and is in opposition to the advancement of the country and the law of the "survival of the fittest." I believe that a workman should receive all that he earns and no more, if only a proper system of piece work could be arranged, so that when a good mechanic produced a piece of work he would receive a stated price. Unfortunately, some

*Edward B. Gilmour in Journal of the American Foundrymen's Association.

employers will continually reduce prices irrespective of the profits which they are receiving, and consequently workmen are compelled to band together in order to protect themselves. Hence comes the tendency of trades unions to go to excess in their demands and in the restrictions which they have unwisely put upon production.

Adam Smith says that "the source of wealth is labor." "The amount of labor of every nation is the fund which originally supplies it with all the necessaries and conveniences of life which it annually consumes." With this knowledge in mind it would be well for the employer and his workmen to co-operate and bring forth a higher class of labor with more enthusiasm, greater economies and higher productive power, every man in a spirit of emulation doing his best, as a soldier dare not be a coward but goes forward with a will in order to reach the highest goal. Therefore let every American employer and his workmen remember that their interests are co-equal, and with the freedom which is granted in this great country there should be no limit to the amount of good which can be produced in the elevation of both parties morally and physically.

Echoes from the Oil Country.

RED TAPE.

I would like to be always right, but as I cannot be, in all things, I will try to do the next best thing, and when I find I am wrong, see if I cannot shift my ground. And just now I feel that I owe some one, or a class, of my countrymen an apology.

Since I first began the work that I have done at the trade I have had a kind of distaste for red tape and not much admiration for those who seemingly were bound by it. Many and many a time have I had men come in with work and had them tell me how they would not take work to other shops because of the ceremony necessary to go through in order to get it done, and I have patted our shop on the back, as it were, for being a superior kind of a shop that had sense enough not to be burdened with such useless hindrances.

If I had not gotten mixed up with that corn-sheller business I don't suppose I should know any better yet, but that showed me a few things that are good to know, if not very pleasant to learn, and I just had to learn some of them, and now I wish I knew all there is to know of them.

I do not know how or when it got there (in my head), but it seems to have been when I first began to know anything mechanical that I found out about red tape and what a tyrant it is and what nonsense it is to have it woven around a shop. Its most congenial home, if not indeed its birthplace, seemed in my mind to have been somewhere in New England, just where, I was not sure, but beyond New York somewhere, where they made wooden nutmegs and watches and things.

Our part of the country was far too advanced to be held down by such petty distinctions as had to be observed in the places under the ban of the oppressor, for there personal liberty, that possession so dear to the heart of all, was narrowed down to a fine point.

"Why I just up and quit. I'm not a dog. The foreman rared up and snorted just because I picked up a tool from the other fellow's lathe. He wasn't using it and mine just got knocked out because I set it a little low, being in a hurry. Foreman said it wasn't honest using another man's tools. Said he didn't want men around him who couldn't stand on their own feet. Said a lot of other things I didn't like, so I just up and quit him and let him run things to suit himself." That was the testimony of one man, and there was plenty more.

"You had to go to the office and get a pass before you could get in to see a fellow," said another, "and spitting tobacco juice on the floor got the boss after you."

"'Obey orders and break owners?' Well, I rather guess. If you just wanted your head to go off quick, just try changing a size on a drawing. Just you think of having to throw a nice true piece away because it is a thirty-second small when you have to bore the hole it is to fit into. Isn't that nice? All because them fellows get a notion in their heads." This from still another. Could anything be more convincing?

"Here, Tom, cut off a piece 25⅜ inches long; turn it down to 2 inches in the middle and turn the ends to 1⅝ inches for 4¼ inches. It's for Davy Jones. Take a piece of 2¼ inches, and don't be all day about it." And I go over to see how near Hank is done with his last job.

"I got this piece you wanted cut off 23⅝ and the ends turned 2 inches for 4¼ on the ends, but I don't mind just what you said about turning it 1⅝ in the middle; just tell me that again and I'll get it finished in most no time." And Tom is waiting for further instructions.

"You great thick-headed buckwheat, I told you to cut that off 25⅜ inches long.

"Maybe that is what you wanted to tell me, but you said 23⅝."

"23⅝ nothing; you keep a little nearer awake and you would know what you are told."

"I guess I worked in shops where they wouldn't let *you* sweep the floor; you just give me my time, and you can cut off your own old scrap and turn it up any old size you want to." And Tom is looking for another job and I am wondering if by any possibility I did call that 23⅝ inches instead of 25⅜ inches.

Hank never did anything like that, no never. "Mr. Osborne, can I trouble you just a minute, just a minute now, I want to be sure before I go too far; it is far easier to make sure than to fix things after they are spoiled. This hole was to be 1¾ inches and to be 1⅞ inches deep—no—yes, yes of course it was to be 1⅞ inches and to be 1¾ inches deep; of course, of course I mind all about it; thank you very much, excuse me for troubling you, but you see I like to be sure, never spoiled very many jobs and been at the business quite a while; always believed in being on the safe side." And off he goes, but presently he will be back to tell me he has the hole bored to 1¾ inches and wants to be *sure* I want it 1⅞ inches before finishing it, because he can still leave it 1¾ inches, but it will be gone when bored to 1⅞ inches if that is wrong.

"Here, Hank, I have made a little sketch and marked the sizes on it; you work to them and I will be responsible for the rest." I think that might have saved me losing Tom the other day. I'll try writing all my orders for a time.

That was an opening wedge, and as orders began to come in and corn-shellers to go out and repairs to be needed, I was beginning to make use of lots more, until I found I was beginning to be bound up, and one day a customer woke up with:

"What's getting the matter with this shop, anyhow? Used to be I could come in here and go to any of the men and get anything I wanted; now I have to go to you or into the office and get you to go after it. The men are afraid to do anything for a fellow without you yell."

Sure enough. One by one they had been creeping in until I now see that there are lines of red tape running all around the shop. Indeed, I find that my best men have little private lines of their own, and that quite a bit of their value as workmen depends on the skill with which they keep the tapes from tangling.

One day a man unthinkingly cut one of my tapes. It was in his way, and that was much the simplest and easiest way to get it out of the way. After a while things began to go wrong and the reason was looked for. Tracing back from the trouble after quite a hunt we found the starting point. It took a whole lot of time and trouble to get that tape mended, and the worst of it was that the work that had been done in the meantime was like weaving where part of the warp is broken—not only imperfect but impossible to completely remedy without cutting out and throwing away quite a piece, and then there must be a spot when the repairing has been done.

I do not know just how much red tape is best for a shop. Personally, I like to get along with very little, but I don't want that little to be cut and snarled and trampled on by anyone. I haven't any love for it for itself alone, but I am beginning to respect and admire it for the help it gives me in getting out corn-shellers, and to understand that when I put a strand of it into use I should make it like the old Pennsylvania legal fence, "bull strong,

horse high, and hog proof." If I can't come pretty near that I had better go slow about putting it in.

It has begun to permeate through my skull that the American system is largely controlled by a judicious selection and application of red tape, and that without the tape the value of the system would be very much diminished.

A young darkey one day tried to sell a man a puppy, saying it was a good "democrat bull-dog," but the man did not buy it. A few days later he tried to sell it to him and said it was a "republican bull-dog."

"Why, you young scamp; you called this a 'democrat' the other day." "Oh, yes sah! but dat all right, sah! He done got his eyes open now."

If any of the master minds that have devised the wonderful systems (or those who are working them) that have made "Yankee" production the wonder of the world should chance to see this I wish them to know that my eyes are beginning to open, and that I am ready to take off my hat to them and "take it all back," and not only that, but I will carry off and appropriate as much of their ideas to my own use as I am able to handle to advantage, unless they are patented.

There is one idea that comes to me very forcibly that is no doubt well known and considered by others, but which I see very little mention made of, and that is the laws of mechanics as applied to men. As quick as thought is a favorite expression with some writers when wishing to express extreme speed, yet a snail is speedy compared with the thought of some men if that thought is in an unaccustomed channel.

The Laws of Force apply to mind as well as to matter, and if forces are acting to deflect and retard as well as accelerate no mechanic would expect as high a velocity as if they were all acting in the same direction. The most valuable part of any man in a machine shop is from his ears up. Aside from downright dishonesty, I think the worst recommendation a foreman can give a man is this: "He means well enough and works hard enough, but he hasn't any *head*."

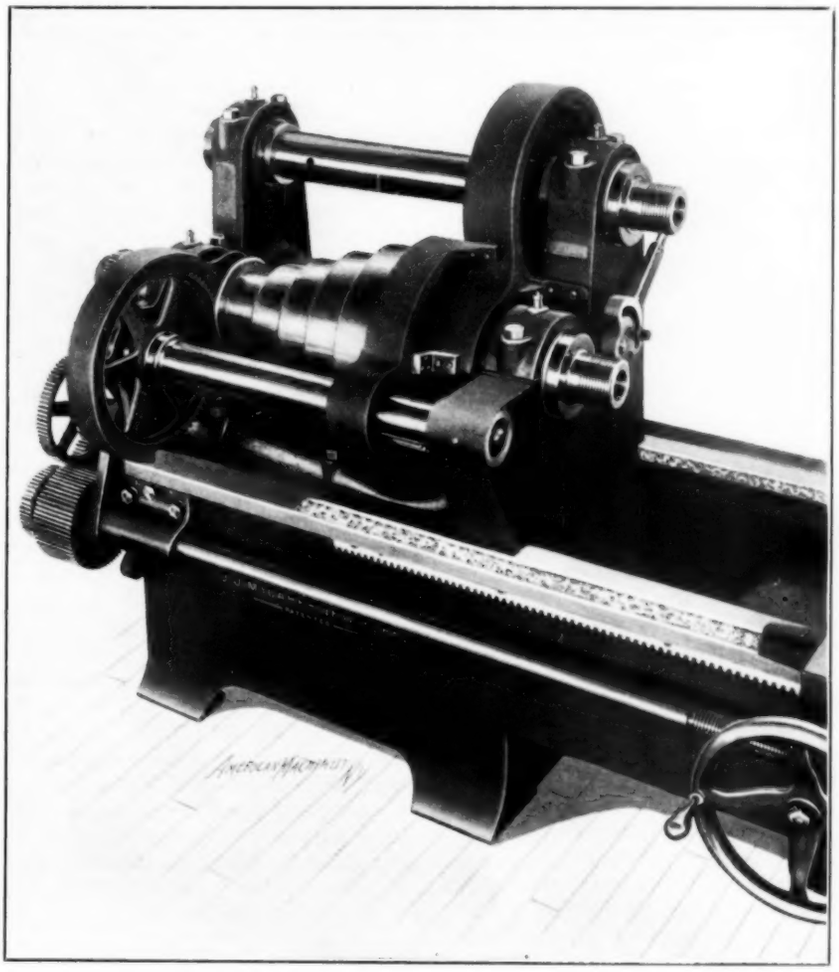
The Law of Inertia is extremely important, and red tape seems to take advantage of it to keep things going at a high velocity, but in one direction.

I *have* heard a faint rumor that there are those who become so enamored of red tape that they worship it as an end and do not use it as a means, and that these really are the ones who bring it into disrepute. I would like to see and examine such a shop, to have some standard of comparison in my mind, but would greatly dislike to get tangled up in its meshes. Perhaps the Scranton people may by and by add a "department of red tape" to their courses, and thus post a "greenhorn" as to how much and what kind to use and what pattern to weave with it. In the meantime I will experiment a little.

W. OSBORNE.

Improved Two-Spindle Lathe.

There are various lathes with two or more spindles for various lines of service, but the McCabe two-spindle lathe is in a class by itself and distinctly fills an immediately recognized want in many a shop. We have illustrated and described this lathe more than once, as it has been successively improved from the original design, and there is occasion now for another illustration of it which our readers will welcome. The half-tone tells its own story. The most striking change is in the location of the "back gears," which are now front gears instead. This is not a caprice, but a change with a reason for it. This change has made possible a change in the location of the two spindles in relation to each other and also in relation to the lathe shears. It makes it possible to use a larger intermediate gear in driving the larger spindle. This gear is thrown in and out by the slotted lever seen in front of the headstock. Bringing the back gear to the front gets rid of the lifting thrust of the drive and keeps the pressure constantly downward in the main bearing, as in many roll and gun lathes. The drive is stated to be made 25 per cent. stronger by the changes in the gears. The gears are, as will be seen, completely covered, which protects both them and the operator. The lathe is made by J. J. McCabe, 14 Dey street, New York city.



IMPROVED TWO-SPINDLE LATHE.

Rapid Boiler Making.

A contributor to the *Engineering Magazine*, Egbert P. Watson, says:

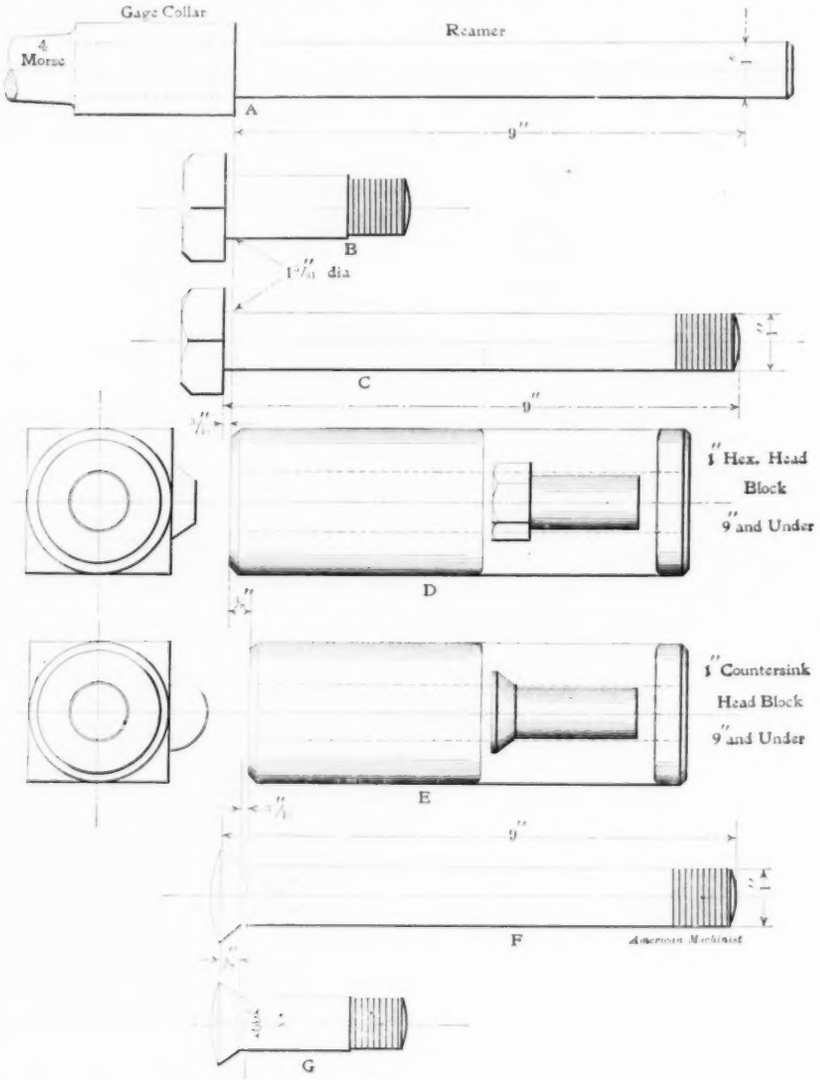
"A modern boiler shop is far different from its congener of half a century ago. It is not generally known that a boiler of 40 horse-power can be made and shipped in about eight hours. That is to say, if an order is put in by 7 o'clock in the morning it can be on the way to its destination by 3 o'clock on the same day, ready for steam when set. This boiler will be taken from the flat sheets, rolled to dimensions, all rivets driven, tubes set and rolled, and the work made water and steam tight within the time named; but it will be of the return-tubular type, where no smith work or flanging is required. This is quick work, and I know of one shop where it is done; doubtless there are others."

This we find copied in a New York daily and credited to the *London Engineering Magazine*, the paper evidently

thinking that this is a record of English practice in boiler manufacturing. The *London Engineering Magazine* is really the English edition of the *Engineering Magazine* of New York, and the record of boiler manufacturing speed is based upon American practice.

A Standard System for Taper Bolts.

The question as to the best method for holding together two or more pieces of metal, comes to the attention of everyone who designs or constructs machinery. It is customary to use for that purpose, tap bolts, studs, single loose fitting bolts, finished straight and taper bolts. Where a through bolt is possible it is generally preferable to use a finished taper bolt, especially in cases where it is not convenient to use dowels. A straight bolt, if made to drive, gives trouble when it is being fitted and also when it is driven out, often cutting and tearing the hole. The almost universal use in locomotive and other work of bolts having a taper of 1-16 inch per foot has led n to believe that the standard system for taper bolts adopted by the Baldwin Locomotive Works would be useful to the trade in general, and it is through the courtesy of Mr. S. M. Vauclain that it is now described.



A STANDARD SYSTEM FOR TAPER BOLTS.

All bolts in this system are fitted in reamed gages made of cast iron and of suitable length and section; the gages are known as 9, 12, 18, 24 and 30-inch blocks. A bolt 9 inches in length—measured from under the head to the point—is taken as a starting point. This bolt (shown in the sketch at *C*) is exactly 1 inch in diameter at the point, and, consequently, at a taper of 1-16 inch per foot it is 1 3-64 inches in diameter under the head. Then the 9-inch block, shown at *D*, being 1 3-64 inches at the large end of hole, the 12-inch block would measure 1 1-16 inches diameter, the 18-inch block would measure 1 3-32 inches diameter, the 24-inch block would measure 1⅛ inches diameter, the 30-inch block would measure 1 5-32 inches diameter.

All bolts 9 inches and under in length—as *B* and *C*—are fitted in the 9-inch block, all over 9 to 12 inches in the 12-inch block, all over 12 to 18 inches in the 18-inch block, all over 18 to 24 inches in the 24-inch block, all over 24 to 30 inches in the 30-inch block.

It will be noticed that a reamer of length suitable to ream a hole for a 30-inch bolt would answer for any bolt of lesser length, but would be too clumsy.

In practice it is found more convenient to have reamers for each gage division and these are known as 9, 12, 18, 24 and 30-inch hand and machine reamers. The flutes of all reamers are made long enough to allow for 3-inch wear.

Gage collars, as shown at *A*, reamed and counterbored, are driven on the upper part of the flutes and under shank or head, and coming exactly to the top of block when the reamer is inserted, insure a hole in the work the same size as the hole in the block.

All holes being reamed standard, the allowance for snug driving fit is made by fitting all bolts to stand out of gage block 3-16 inch, which with our taper has been found to be sufficient.

A taper of more than 1-16 inch per foot offers no advantage, but has the fault of making a long bolt too large under the head.

Thus far we have considered only the hexagon and square head bolts. Two other kinds are used, the countersink and the round counterbore head bolts. The countersink head bolt, shown at *F* and *G*, is used in places where a hexagon head would interfere. The included angle of this head is 60 degrees and the head is ⅜ inch thick. This style of bolt requires a gage block, as at *E*, so made that the standard plug gage will stand out ⅜ inch. The counterbore head bolt is used where a very strong concealed head is desired, the head usually driving snugly in the counterbore. This style bolt is fitted in the hexagon head bolt gage. The hole for this bolt body when reamed is made the size of the bolt under the head.

The same reamer is used for all bolts, and the same allowance for drive, viz.: 3-16 inch, is made for all styles. The blocks as shown in the sketch have cast on the side a descriptive shape which aids the workman in finding the one desired, whether hexagon or countersink.

This system has worked admirably since 1884; it recommends itself in that it contains but few standards for each nominal diameter of bolt and provides for a multitude of lengths.

To preserve the sizes a master set of plugs is kept in the toolroom. When the gage blocks are worn they are easily restored to standard by re-reaming and facing off top to suit plug gage.

Our blocks run in the following lengths for regular diameters: ¼, ⅜ inch—6 inches (pins and bolts); ½, ⅝, ¾ inch—9, 12 inches; ⅞ inch—9, 12, 18 inches; 1, 1⅛, 1¼, 1⅜, 1½ inches—9, 12, 18, 24, 30 inches. H. E. B.

Cost of Ordnance at Watervliet.

According to published figures, the cost of making ordnance at Watervliet Arsenal is as follows: 12-inch breech-loading rifle, $30,248.15; 10-inch breech-loading rifle,

$23,424.48; 8-inch breech-loading rifle, $12,269.22; 6-inch rapid-fire gun, $7,527.06; 3-inch breech-loading rifle, field piece, $2,677.20. The 12-inch breech-loading mortars cost only $10,352.57, and the 10-inch mortars cost $6,866.57.

The Value of Up-to-Date Tools for Railroad Work.*

The amount of money that is wasted every day by the lack of "up-to-date" tools is appreciated by very few railroad officials. Even many superintendents of machinery and master mechanics do not fully realize the saving that can be effected by replacing worn-out and obsolete machines with others which are strictly "up to date" and fitted with all the latest improvements. If an old machine can be replaced with a new one which will do enough more work or do the same work with enough less labor to represent a saving in money equal to 5 per cent. per annum on the investment, it should be entitled to careful consideration, as this is the basis on which other railroad improvements are figured. How easy then ought it to be for mechanical men to obtain approval on a requisition for a machine which will save from 10 per cent. to over 100 per cent. per annum on the investment. A few actual examples of such savings may be needed to convince those who have not studied this question, or others who have not had the new machines to compare with old ones.

(1) In a railroad shop employing about 160 machinists there were no horizontal boring machines for such work as boring driving-box brasses, rod brasses, rocker boxes, air-pump cylinders, etc., and all such work had to be done in lathes, milling machines or drill presses. After repeated conferences and much argument, accompanied by estimates of savings that would result, permission was obtained to order a No. 2½ horizontal boring and drilling machine with 4-inch bar and latest attachments. It has been in use about eighteen months and shows earnings by money saved as follows:

Original cost of machine installed ready for work	$1,696.00
Average savings per year as compared with old manner of doing same work	900.00
Interest on investment	53 p. c.

It formerly required three hours to bore a driving-box brass for a 9x12-inch journal in a milling machine and about four hours to do the same work in a lathe, whereas they are now bored in one hour in the horizontal boring machine. Rocker boxes, tumbling-shaft boxes, etc., are done in one half the time formerly used. In boring air-pump cylinders it was formerly necessary to take the pump apart and set and bore each cylinder separately, requiring from two to three hours each. In the new machine it is possible to bore all four cylinders of a New York pump at one setting, without taking them apart, and it requires but an average of one hour for each cylinder. In addition to the saving in time, much greater accuracy is insured. It is very conservative to say that this machine does double the work of the old ones, thereby saving the wages of one machinist at $3.00 per day for 300 working days, or $900 per year.

(2) An old car-wheel borer was replaced by a new, heavy 42-inch borer with hub-facing attachment, power crane for handling wheels, etc., which cost installed $1,710.90. This wheel borer saves the wages of one helper three hours a day and does more than double the work of the old machine, making a total of $2.45 per day, or $735 a year, which amounts to 42½ per cent. on the investment.

(3) A new, heavy double-head car-axle lathe, costing $1,665 installed, turns out one-third more work than the old one on account of taking a heavier cut and heavier feed, thereby saving about $250 a year, or 15 per cent. on the principal.

A long list of such examples could be given to show the increased earning power of machine tools which are strictly up to date. Tools are not up to date when there is something else on the market which will do more work or do it at less cost for labor. They need not necessarily be worn out to be wasteful by comparison. Most engine lathes of modern design have greater power, weight and strength to withstand heavier cuts and coarser feeds than those built twenty or twenty-five years ago, which enables the former to turn out from 20 to 30 per cent. more work. This represents savings equal to from 15 to 35 per cent. interest on the investment, varying with the cost of the lathe and the class of work for which it is used. Recent planers are built 30 to 50 per cent. heavier than they were twenty years ago, with greater power and quicker return, the latter running as high as 72 to 80 feet per minute as compared with 40 feet or less for the older machines. They are also fitted with three or four tool heads, whereas the old planers had only one or two at most. This means an increase of 25 to 50 per cent. in the amount of work done, or earnings of 10 to 25 per cent. on the amount expended for the machine.

The various types of turret lathes for making bolts, studs and pins from bar iron are well adapted to locomotive work and will easily turn out twice or three times as much of this class of work as will an ordinary old-style engine lathe. Such machines cost $1,600 to $1,800, and make a return of from 50 to 60 per cent. in savings. The large automatic turret lathes for turning piston heads, cylinder packing, bull rings, balanced valve rings, etc., will do double the amount of this work that an engine lathe will, and the same may be said of the latest boring and turning mills. Many improvements have been made in drill presses, among which may be mentioned easier and quicker adjustments of both spindle and work, swiveling tables, tapping attachments, multiple spindle drills, variable speed countershafts, etc., all of which help to increase the output.

Milling machines are great time savers on certain classes of work which used to be done on slotters, shapers or planers, and are especially economical where a large number of duplicate parts are to be made. Every toolroom ought to have at least one universal milling machine, and there are various jobs of locomotive work that can be done to great advantage on such machines. The percentage of saving to be obtained depends not only on the original cost and amount of additional work done, but also on the rate of pay and skill of the operator and the number of hours the machine is run. As a rule, improved small tools will therefore earn a larger rate of interest on the investment than larger and more expensive ones. There are very few railroads to-day which have not more or less pneumatic drills, hammers, riveters, hoists, etc., and no argument should be necessary to demonstrate their earning capacity, but the value of air jacks for cars and locomotives is not so generally known. It formerly required about four hours for eight men with screw jacks to take a ten-wheel engine weighing 132,000 pounds off its drivers, at a cost of $5.14, and about one-half that time for four men to do the same work with hydraulic jacks, but using four pneumatic jacks it is now regularly done by four men in one hour, at a cost of 66 cents. However, to be strictly up to date, an electric crane should be used and the time reduced to ten minutes. A pneumatic ram was recently made at a cost of $168.55 for breaking staybolts to remove worn out fireboxes, which earns very large interest on the investment. It formerly cost $45.60 to cut out the crown bolts and staybolts of a ten-wheel locomotive with 9-foot firebox, using three men, but with the pneumatic ram it is done by two men for $15.20, thereby saving $30.40 on each firebox. If only one firebox was removed each year this tool would earn 18 per cent. on the investment, but as this shop applies thirty new fireboxes a year the saving amounts to $912, or 541 per cent. per annum on the amount invested.

The improvements and radical departures during the past ten or fifteen years, from old practice in the manufacture of machine tools for metal working, have been much greater than in wood-working machinery; but recent designs of planers, tenoners, molding and mortising machines are much heavier and more powerful and will do from 25 to 50 per cent. more work than old machines. The hollow chisel mortiser is an ingenious and very profitable tool for any shop, and the four and six-spindle boring machines are great

*M. K. Barnum, M. M., Union Pacific R. R. before Western Railway Club.

labor savers. Wood trimmers are most valuable additions to the equipment of cabinet or pattern shops, and the new pattern and corebox machines will easily earn 100 per cent. on their cost if used one hour a day.

In figuring the earnings of the up-to-date tools in the above examples, only average results have been taken and not special cases of unusual savings. No credit has been allowed for the scrap value of old machinery thrown out, nor have we considered the saving in shop room due to the use of more efficient tools; and last, but not of least importance in railroad work, is the reduction in the number of days locomotives must be held out of service for repairs, which will follow the use of up-to-date machinery. In a certain shop which makes general repairs to about 160 locomotives a year the average length of time required to put each engine through the shop was reduced from thirty-four days in 1898 to thirty days in 1900. This represents a saving of 640 days for one locomotive, which, at a rental value of $10 a day, gives $6,400. As this was done with the addition of only a few new machines in a shop full of old and worn-out tools, many of which had been in service from twenty-five to thirty-five years, you can readily understand how much greater saving could have been effected had the shop been fully equipped with up-to-date machinery.

In discussion of the above paper the following was contributed by Mr. R. T. Shea, piece-work inspector of the Chicago, Burlington & Quincy Railway:

"I noticed on page 4 of the AMERICAN MACHINIST, under date of February 13, a full-page advertisement, in which it says: 'Piece workers in one of the largest United States shops, a superintendent says, besiege him for the use of any —— lathe that happens to be empty. Piece workers have no sentiment in such matters; they want big, generous feeds with ample solidity and power.'

"It occurred to me that this advertisement is one that many of our mechanical men in railroad shops might read with a good deal of thought. As soon as men go in business for themselves they see the importance of having tools that are up to date and that will do the work in the least possible time. I recently visited one of the largest steel-working plants in the United States, and they pointed out to me two rows of large lathes that would swing about 40 inches (the kind that the average master mechanic of a railroad shop would be delighted to have), and they told me that those lathes were for sale at their scrap value, and wanted to know if I could use any of them at that price; that the entire number were to be thrown out and new ones substituted that would do the work in less than half the time. It has always been a question of getting tool steel that would stand the cut and feed that the present tools were able to pull. To-day the question is to get a machine that will pull the cut that the tool steel will stand. It is remarkable the rapid strides that have been made in the last two years on tool steel. My attention was recently called to making a price for a given operation in a railroad shop. One shop wanted $13, which was the minimum price; the other shop, with a new and improved tool, asked for $4.20. After careful investigation, I found that the prices asked for in both cases were right, and there was actually this difference in the two tools. If a railroad company had much of this kind of work to do, and it was necessary on account of local conditions to do this work in two different shops, I think it would be an easy proposition to show the management of a railroad how much saving would be made, and how quickly the machine would pay for itself.

"We had another case recently in one of our wood-working shops on a matching machine: The decreased cost for running lumber through the new tool, as compared with the old one, paid for the machine and installing it in less than six months.

"There is another quite important fact that I believe is confronting the mechanical men of railroads to-day, and that is, that we have been buying new engines by the hundreds of a very much larger type than was ever used before in railroad work (I mean in a general way). It is a well-known fact that these large, heavy engines will not stay out of the shop as long as the lighter ones, and that the work on them is very much heavier than on former engines; that the average railroad is away behind in shop facilities, and the management will sooner or later have to realize that they cannot continually increase the number and size of engines without a corresponding increase in shop facilities, and that in considering requisitions for new machinery this matter should be taken into account: the mere fact of having what appears to be a large shop with a number of tools won't keep the engines in repair to pull trains over the road.

"I have been led to believe that the men in the ranks are entitled to a great deal of credit for the present high state of efficiency of many of our large railroad shops where the shops have been put on piece work, or modifications of it called by whatever name you please. The reason I say this is because wherever men have gone into business for themselves this way, they have at once objected to the flimsy tools they have been asked to work on. The gears have been broken because they would not stand the cuts; friction clutches have been thrown out, and positive feeds and pulleys have taken their places; steel gears have been substituted for cast iron, all at the request of the men in the ranks, and if these men in the ranks demand better tools to do the work, it shows the importance of it, and the management can certainly afford to give the matter a good deal of study, and I hope that Mr. Barnum's paper will start them to thinking."

The Messenger.

A REPLY TO "CARRYING A MESSAGE TO GARCIA."

When "the fellow by the name of Rowan" was sent for and given the famous "Message to Garcia", how he took it and what he did is on record in words as stirring as the deed itself.

The instructions given him—the limitations on his freedom of judgment we have no means of knowing. We assume he had a free hand—the responsibility was his—he was looked to for results and the selection of the best means to achieve the desired end was his concern, and his alone.

Right here is the reason so many messages never reach Garcia. We are told the world needs the man who, when told to do a thing, will "say nothing, but go and do it"—we are told "he is wanted in every city, town and village, in every office, shop, store and factory."

He *is* wanted, badly wanted, but nine times out of ten he is just where he is needed, and, given a fair chance, stands ready to meet the need. He is not nearly so scarce as some would have us believe.

"The fellow named Rowan" was not told he must travel by a certain line, because those in authority were financially interested therein. He was not instructed that if he needed horses he must buy them from the So and So Company for the same reason. If he required assistants, his selection was not limited to this official's cousin's son, or the other's grand-nephew, quite irrespective of the qualifications of either.

The man who does not carry a dinner-pail, nor yet is an employer of labor, is the man looked to to "say nothing but do the thing," and too often his usefulness is impaired, his value lessened, and himself disheartened by needless limitations of the right to exercise his own best judgment of ways and means. Too often those with a "Message to Garcia" feel they must tie the messenger down to follow in every detail their judgment instead of his own.

In offices, stores and factories we find him—the man looked to for results—held responsible for failure, yet debarred from selecting what he knows are the best means to achieve success; the office manager, compelled to refuse the small advance in salary asked for by a good clerk, an advance that means all the difference between hopeful belief in success and disheartened admission of failure; the chief clerk, obliged time and again to overlook inability, indifference and inattention in a "relation of the bosses"; the foreman, forced to keep down expenses by makeshift repairs or tools.

Men who will "say nothing but do the thing" are not scarce—thousands of them are to-day in positions where their useful-

ness is limited by cast-iron rules as to how the thing is to be done. If the men with messages to send would more nearly limit their instructions to the main facts necessary there would be fewer important messages go astray or fail to be delivered.

There are some men—may their number increase—who realize that responsibility implies authority; who recognize no relationship in employees, no claim but that of loyalty and service; who would rather have their best employees make mistakes of judgment now and again than always escape by shirking responsibility and avoiding decision.

Verily, such men have a threefold reward—in loyal, willing service, such as money alone cannot always command; in the results such service necessarily produces, and in their own greater freedom for other and more important things.

KENNETH FALCONER.

Machine Molding.

MOLDING A WHEEL GUARD.

BY GEO. BUCHANAN.

The wheel guard casting, Fig. 1, is rather an awkward piece to mold on the bench and considerable skill is required to produce good castings. As this casting forms one of the parts of an implement for which there is a growing demand it was decided to place all of the castings on

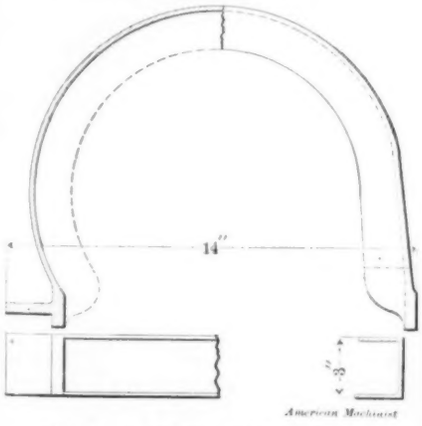


FIG. 1. A WHEEL GUARD CASTING.

molding machines. I propose to give from time to time, as occasion offers, the various methods employed in placing these (in some cases intricate) pieces on the molding machine.

Taking the guard casting (which is one of the parts causing trouble on account of the small quantity made at each blow, sometimes delaying the building and consequent delivery of the implements) as a starting point, the result was excellent, the number of castings being four times greater when made on the machine than by former methods and the price per casting being reduced from 6d. to 1½d.

Fig. 2 is a view of a stripping plate molding machine head with the guard pattern mounted thereon. Fig. 3 is the same head with the pattern drawn down

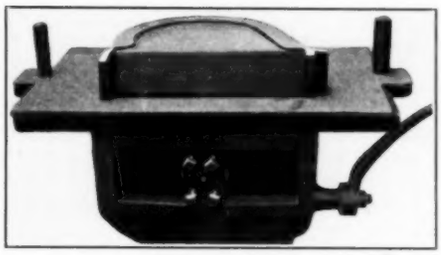


FIG. 2. STRIPPING PLATE WITH GUARD PATTERN.

through the stripping plate. Fig. 4 shows the plate and ring which form the core for the mold, and Fig. 5 shows the core rammed up and the ring removed.

The sectional views in Fig. 6 show the method of locating the green-sand

FIG. 3. STRIPPING PLATE WITH PATTERN DRAWN DOWN.

core in the mold. *A* is the drag which, having been rammed up on the machine and the pattern drawn, as in Fig. 3, is placed on to the core plate, as on *B* and Fig. 5, the pins on the plate being duplicate to the holes in the drag. The drag and plate are next rolled over and the plate

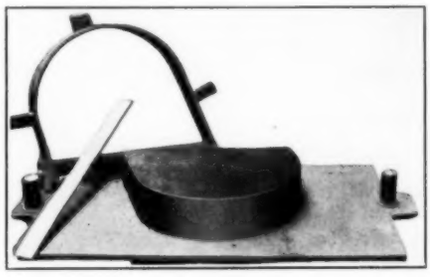


FIG. 5. CORE WITH RING REMOVED.

removed, as shown at *c*. The top part is made on a flat plate having a hole drilled to locate the gate pin. The green-sand core is made without any sprigs or rods to support it in the mold, neither is it vented, but is tucked loosely with the

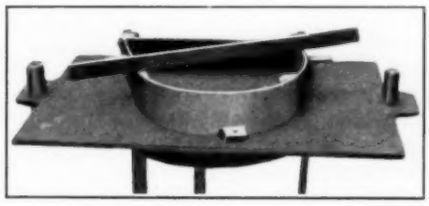


FIG. 4. PLATE AND RING FOR CORE.

hands. Considerable trouble was experienced in getting the drag to touch evenly on to the green core before rolling over, but this having been secured no further trouble was found.

Wrexham, N. Wales.

Germany Speeding Up.

United States Consul Frank H. Mason writes from Berlin of experiments which are being made in Germany with electricity on railroads, especially for the purpose of attaining high speeds, even up to 125 to 150 miles per hour. A speed of 99 miles was obtained, which was all that the road-bed would stand with safety. It was shown that with a sufficient voltage the

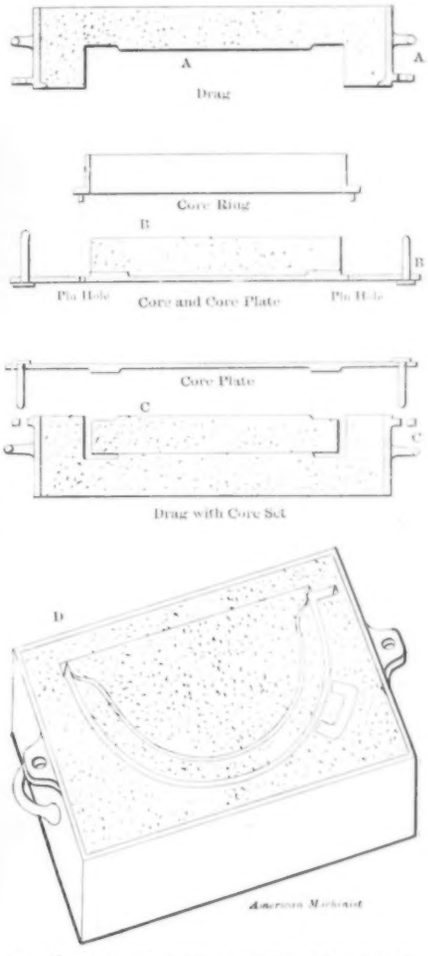


FIG. 6. SECTIONS EXPLAINING MOLDING OPERATIONS.

current could be got into the car for any speed desired, but the road would have to be practically rebuilt. The German Society of Mechanical Engineers has voted three prizes for steam locomotives and trains. The engine must be able to haul a train weighing 180 tons over a straight track at 74.5 miles an hour, maintaining this speed for three hours. The cars must have all modern improvements and be capable of running safely at 93.7 miles an hour.

Two mistakes never combined to make a wise action.—*New York Times.*

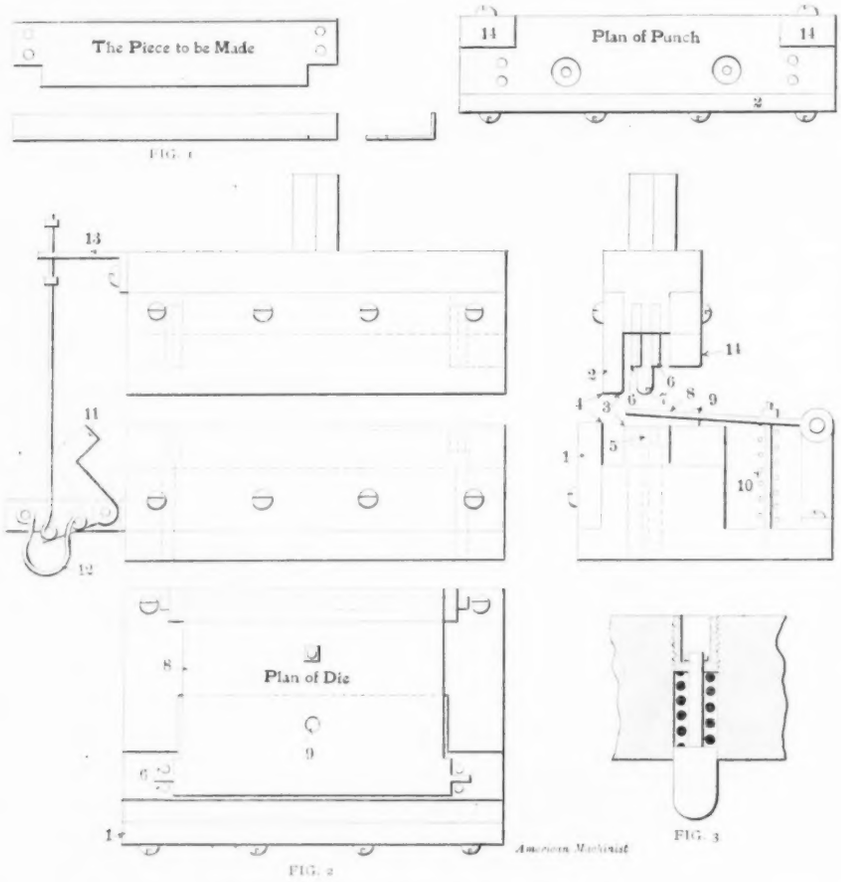
Letters From Practical Men.

A Sheet Metal Punching and Bending Die.

Editor American Machinist:

I send you herewith a sketch of a sheet-metal punching and bending die. Fig. 1 shows the piece to be made. The material is 26-gage sheet steel, the width of the stock used being equal to the length of the piece to be made.

Fig. 2 shows the punch and die. 1 is the lower shear, 2 the upper shear. These have cutting edges at 4. Shear 1 is slightly higher than the die plate 5, to allow the piece to be sheared before the rounded corner 3 of the shear 2 bends the stock



SHEET METAL PUNCHING AND BENDING DIE.

over the rounded corner 3 of die plate 5.

The punches 6 6 and 14 14 are set so as to reach the stock after it has been folded over the corner of the die block. 11 is a "kicker" for throwing the finished piece out of the die when the ram is finishing its up stroke. 7 is a spring bolt to firmly press the stripper 8 on the stock to keep it from creeping while being bent over the corner of the die block.

Fig. 3 shows the spring bolt in section. 10 is spring to raise the stripper so that the stock can be fed against stop 9. This rig finishes the piece with one blow of the punch, punching, bending and cutting off.

J. P. APPLEBY.

"The Alleged Breach of Confidence."

Editor American Machinist:

The position taken by your correspondents regarding the dishonorable practice of some concerns of communicating to an employer the fact of his employee's desire to change his position suggests that the publication of the names of individuals and firms known to indulge in such practices would bring proper retribution. Few good men would offer their services where foul means would be expected to be used in preventing their future advancement. If such methods of dealing with private correspondence are considered by their users fair, proper advertisement of such users will be quite unobjectionable, and will result in their paying the price of their misdeeds by taking the incompetent help, which is all that they will be able to get. It is reassuring to see that so many good men are quick to denounce such dishonorable methods. S. H. B.

The Practical Limits of Peening.

Editor American Machinist:

As I am asked a question it seems to be "up to me" to answer. Mr. Hutchinson tells of straightening, by heavy and persistent peening with a sledge, a shaft which was sprung 1-16 inch. As I had made some remarks about a story of the peening with light taps of a hand hammer and thereby straightening another shaft which was bent ¼ inch, Mr. Hutchinson's story can scarcely be considered to completely upset my remarks. In reply to the query as to what I would have done under the circumstances he narrates, I can only answer that I don't know. I might have tried the peening trick, but I would not have accepted it if I had been the purchaser of the engine. TECUMSEH SWIFT.

Caution Necessary in Correspondence With Employers.

Editor American Machinist:

Every man has certainly a right to obtain a better position, but it is a very good plan to look out for just the sort of arrangements that "Perseverance" tells of. This also applies to answering advertisements in which the name of the advertiser is not mentioned. I do not know how common such agreements are between business houses, but as I got on to the fact a long time ago that it is done I took pains thereafter not to give the name of the firm I was with when looking up a new position, and in a great many cases I have had such mail matter go in care of a friend in another city when it seemed as if this would be advantageous. In answering an advertisement the best method, I think, is to give your experience and salary desired, mention the time that you have been with a firm if you wish, but unless the advertiser gives his name and address it is a very poor plan to give information as to who you are with or have been with, as you cannot tell into whose hands the letter may fall. In a great many cases a specimen of work will be asked for; if you send it, be careful to remove all marks that could lead to its identification.

My reasons for adopting the above methods were of unpleasant origin, and I was sorry to find that some concerns had very curious ideas as to the rights of their employees. The practice of betraying correspondence is exceedingly common; I have heard of several instances and also have run up against it, and my opinion of it would not look nice in print; so I will just say it is a great deal stronger than Tecumseh Swift's. C. A. REFUL.

Belts vs. Gear-Driven Feeds.

Editor American Machinist:

The question of feed belts versus chains, trains of gears or other positive means of conveying feed motions is being now much discussed, and I notice that it has, to some extent, invaded your columns.

You may remember that some time ago there was published an illustrated account in your columns of a milling machine designed by Mr. George Richards, of London. This machine had a feed belt on it, which, as I remember, was about 4 inches wide and ran at a speed which was sufficient, probably, to give the feed motion power enough to break any cutter likely to be used in the machine. The fact is that when feed belts first began to be

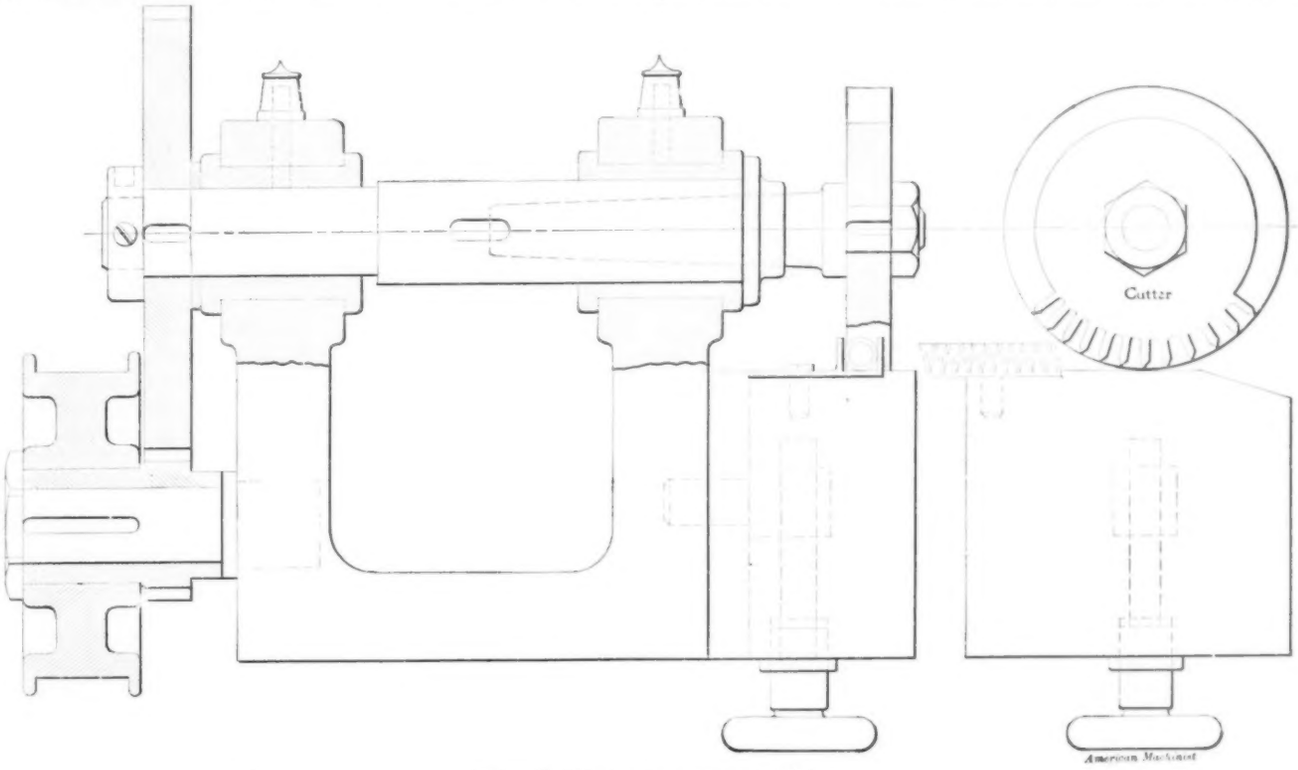
used on lathes and other machine tools, the average feed belt was about ½ inch wide and ran at a speed of about 1½ feet per minute. The application of the usual belt formulas to a belt of this width running at that speed will show that the amount of power capable of being transmitted by such a belt is so small as to be practically undiscoverable, and I am inclined to think that very many have acquired their ideas of the efficiency of feed belts, *per se*, from their experience with such belts; but it ought to be evident that feed belts need not be in such proportion. If for any reason they must be narrow, they can still be run at such a rate as to be capable of transmitting all the power that can possibly be necessary. The average old-fashioned feed belt is not capable of transmitting more than about one quarter the power that is transmitted by the round belt upon a sewing machine, and, of course, it is entirely inadequate to the modern demands of machine tool work.

The fact is that motion is carried to most machine tools of the present day by belts, and it is entirely clear that a belt can be put on the feed pulleys which, if necessary, will transmit all the power that the main driving belt coming down from the countershaft will transmit, and this is the maximum power that can possibly be transmitted by any positive feed arrangement.

Of course I see that there may be advantages in the chain or in a vertical shaft driven by bevel gears as regards convenience of changing the feed rate, or as regards the room occupied. But to say that a feed belt will not transmit enough power is, it seems to me, an absurdity; because whether a feed belt will do this or not depends entirely upon how wide the feed belt is and at what speed it runs.

Taking the case of a milling machine, for instance, and barring frictional resistance in the machine itself, the speed of the belt × its effective pull will equal the resistance encountered the cutter × by its speed. The same relation exists between the feed belt and the platen movement. It is doubtful if very many feed belts have been proportioned on that principle, but if they were, then I think it is safe to say they would pull all the feed the main belt is capable of driving the cutter for, and I think the same may be said of feed belts for lathes. Let lathe feed belts be speeded up to run at such a speed that their motion can be seen by the naked eye and they will do something, and if speeded up sufficiently they will drive all the feed the lathe can possibly take care of, and that is all any feed drive can do.

S. T. FREELAND.



FIXTURE FOR CUTTING OFF SPRINGS.

Fixture for Cutting Off Springs.

Editor American Machinist:

I had about 100,000 short brass coil springs to make for a job, and I tried to cut them off by hand. I found this to be a very tiresome job, so I designed the fixture shown herewith for cutting them off.

The cutter feeds the coiled wire through the guide, which can be adjusted to one side as the cutter gets dull, the springs dropping into a box on the other side.

I have found it, however, more convenient to cut them nearly through and then break them off as they are needed in assembling, because they become tangled up when cut off in the machine, and a great deal of time is lost in trying to separate them.

A. H.

The Structure of Steel as Affected by Heat.

Editor American Machinist:

At page 59 of Metcalf's "Manual for Steel Users" it is stated that if a bar of steel be heated up to the highest plastic limit, *i. e.*, just so it will not fall to pieces, and then cooled slowly, and if it be then reheated to successively decreasing temperatures, as to a bright lemon, a lemon, light orange and so on, in each case being cooled slowly, its friction will be found in the first instance to be coarse and with an exceedingly brilliant luster, the grain becoming finer and the luster less brilliant as the temperature to which it is heated decreases. May I ask you to explain in your columns the difficulties which I find in this statement?

It seems to me that the slow cooling is in each case simply annealing and should bring the metal always to the same structure. As I understand it, steel of any given composition has a certain definite structure corresponding to each temperature so long as it has not been burnt at some time, and if it is quenched it will retain the structure corresponding to the temperature from which it is quenched. If, on the other hand, it is cooled slowly the structure has time to follow the temperature in its changes, the structure requiring an appreciable time for its changes.

The only way I can explain Mr. Metcalf's statement to myself is that he means

rapid cooling instead of slow cooling, or else that I am mistaken in assuming that the structure is dependent upon the temperature alone, and that it is influenced by the highest temperature to which the steel has been raised. In this case the order of heating should be reversed, as the highest temperature should be the last heat instead of the first. Of course, in all of this changes due to working the metal are left out of account.

The natural way to answer this question would of course be to try it, but I have not the chance of doing this at present. ROBERT F. MASSA.

Chicago.

Editor American Machinist:

I have your favor of April 28, inclosing an inquiry about the structure of steel due to heat.

The statement on page 59 of the "Manual for Steel Users" is exactly correct. No matter how a piece of steel be cooled its structure will be affected, fixed, by the last highest temperature to which it was subjected. If the cooling be sudden, such as by quenching in water, the effect will be more marked than when the cooling is slow, but in either case the effect of the last highest temperature will be there, plain to be seen.

I have been asked often why a piece of steel cooled slowly will not come down to the same structure from any temperature. It seems to be a rule of crystallization; the higher the heat the more plastic the steel, and in cooling the largest crystals will grow from the highest temperature. I know of no other explanation.

Bracburn, Pa. WM. METCALF.

The Foundry Trade School.

Editor American Machinist:

I cannot agree at all with Tecumseh Swift's conclusions as regards Mr. West's proposed school. His conclusions based on the result of technical college work are perfectly ridiculous. The student's time in the foundries of technical schools I believe does not amount on the average to more than fifteen days altogether. Now, their work, poor as it is, does not compare very unfavorably with the ordinary apprentice's who has only worked fifteen days.

We have two apprentices at work on box caps with projecting brackets to go on the posts in a building. All the work one of them had ever done at molding was to make 100 flange pipe couplings. The castings he is making are as good as the journeymen would make, and even better than they need to be for the place. He is unquestionably an exceptionally good one, and that is exactly the class Mr. West would have every reason to expect he would have for his pupils, scholars, students or apprentices—whichever one chooses to call them. Why such young men, who have worked three years, just the same as they would work in any other shop, could not turn out good castings, give proper instruction to the first year's men, and, if they received no compensation, or very little, the shop could not be made to pay, after it got well started, I cannot see.

In addition to the learning of the trade, working, say, eight hours a day instead of ten, or seven hours in the place of nine, and during the other two hours receiving instruction in such studies as would be of use to them in their business, the students would get what in the end would prove to be better compensation than the dollars generally given to apprentices for their services. As to the connection of such a school with the National Foundrymen's Association, that would show itself in a very emphatic way, I fancy, by the time the men began to appear in their foundries. It does not seem to me at all safe to say that no good work can be done, nor no one learn a trade in a school, until the thing has been tried, not once but several times by different men.

Not until it has been so tried where the attempt is in a shop with a school attachment instead of a school with a shop attachment shall I believe that it cannot be done. I would like to devote the remainder of my life to the attempt, anyhow.

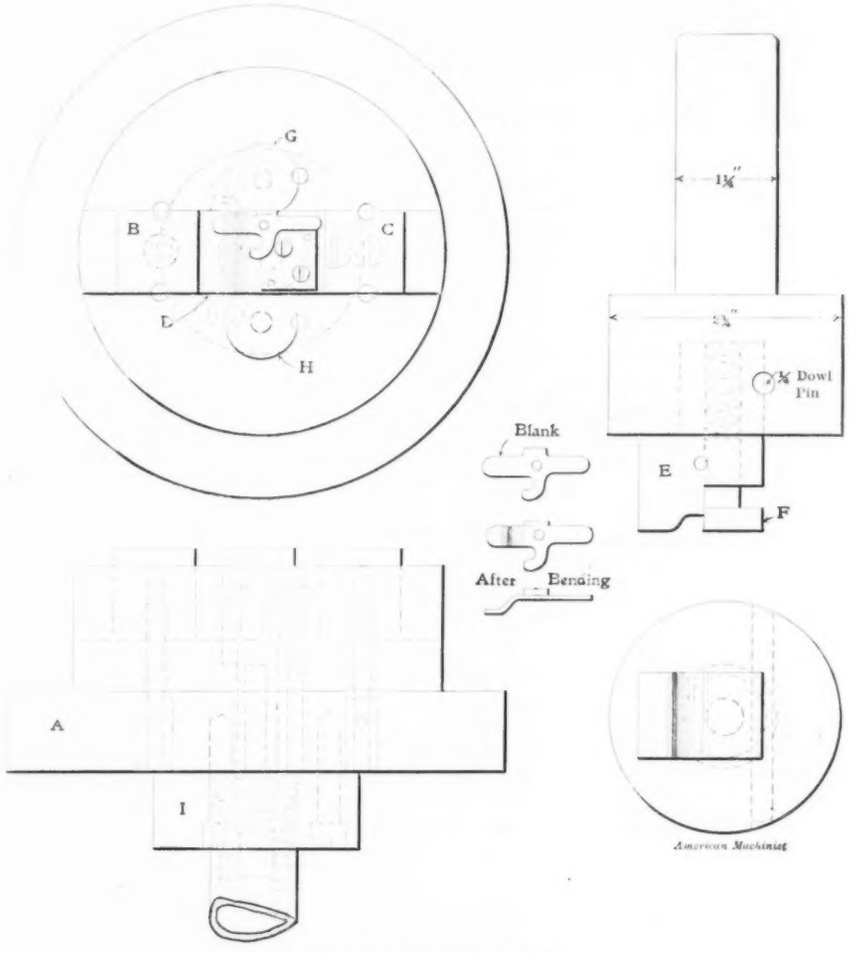
JOHN E. SWEET.

Tools for Bending a Blank.

Editor American Machinist:

The drawing herewith shows a small piece to be bent and the tools for doing the same in one operation.

The die bed *A* was first bored out and pieces *G* and *H* fitted, doweled and made fast, after which it was milled out for the other working parts *B*, *C* and *D*. It was then bored out for the ejector or plunger *D* and fitted in place. The usual plate *I* for the tube which contained the spring for the plunger was then made fast, which completed the die. The punch holder was of the ordinary type bored out for the punch *E*, which was made a driving fit and doweled fast. The hole was then located for the steady plunger *F*, indicated and bored, after which the plunger was machined and fitted in place.



TOOLS FOR BENDING A BLANK.

Parts *B*, *C* and *H* were left ¼ inch higher than the die bed *A*, so as to back up the punch. Part *G*, on which the right-angle bend was made, was even with the die bed. The offset bend was made on the plunger *D*, which was held to the surface of the die during this part of the operation by a very stiff spring, after which it passed down into the die and the offset bend was made. The stock used was .067 inch thick. C. O. D.

The Premium Plan at the Works of David Rowan & Company.

Editor American Machinist:

I have read with much interest Mr. E. G. Herbert's article, published at page 259, on the "Premium Plan at the Works of David Rowan & Co.," and shall do my best to give him a fuller explanation of the points on which he does not seem to be quite clear.

Mr. Herbert is not quite correct when he writes that Mr. Rowan's system offers far less inducement to his men to increase their output than piece work, and considerably less than any other premium system.

It is a pretty well established fact that the limit which a man is allowed to make on piece work is about time and quarter to time and half. This condition of affairs is governed by competition.

With our system we encourage the man to make as much as he can. When a man is allowed 100 hours for a job and does it in sixty hours, suppose his rate is 30 cents per hour, with my system he earns 12 cents, with Halsey's system he earns 6 6-10 cents, with Weir's system he earns 10 cents and with piece work he earns 20 cents per hour over and above his ordinary rate of wages, assuming he is allowed 100 hours multiplied by his hourly rate of wages as the piece-work price.

When Mr. Herbert states that it is a matter of common experience that the reduction of day work time on a given job by, say, 20 per cent. is a *comparatively easy matter,* if sufficient inducement is offered, I entirely disagree with him in this statement. It is certainly not our experience since we introduced the premium system into our works. Our experience has been that the men reduced their day work time by about 15 per cent. when they were put on the premium system, all conditions remaining the same.

Quoting from Mr. Herbert's article: "Mr. Rowan calls particular attention to the high wages offered by Messrs. Weir to the man who reduces the time on his job to one hundredth of the time allowed him," and continues: "May it not be reasonably doubted whether the inducements offered by Mr. Rowan's system are likely to result very often in this stage being reached? Mr. Rowan says at this point, 'Messrs. Weir will require to cut their rates.'"

Certainly, Messrs. Weir will require to cut their rates, if their business is at all a competitive one, for the very same reason that piece-work rates require to be cut.

Suppose three firms are manufacturing three similar articles; the first has adopted Halsey's method, the second Weir's, and the third Rowan's. Each firm gives the man in their employ 100 hours to do one of these articles. In the course of time each firm is doing that piece of work in one hour. The firms are competing with one another. In a case of this kind the firms which adopted Halsey's and Weir's methods would simply be out of the running in the market (see table at page 49), and it is also to be noticed, although we have never attained to such a reduction as this, that, if it is ever done, about 15 per cent. of the reduction of the time will be due to the man. All the rest will be due to the management—that is to say, they will have introduced new machines, new methods, etc., and the man with us will be receiving his wages plus 99 per cent. Fifteen per cent. of this will be due to his own ability or exertion or to both combined. He is paid the rest for assisting the firm to accomplish the further reduction. In *The Engineer* of April 18, 1902, Dr. Barr wisely remarks that it is reasonable to assume that a workman will not be entitled, on account of extra exertion, to receive more than double the wage he is prepared to accept and has agreed to accept on time work. Dr. Barr speaks from experience, and from a good experience of the introduction of our system.

I could quote many firms in this district and in England which have adopted the premium plan within the past two or three years, but I do not know of a single engineering firm that has adopted piece work during the same period; of course, I am referring to firms which had been working on day time.

Mr. Taylor's paper on the "Premium System" is an excellent one, so is Mr. Halsey's, and both might be studied carefully with advantage. Mr. Taylor's paper does not advocate the analytical method put fortn by Mr. Herbert, but he does advocate a method of analyzing the time taken to do a piece of work, from the time the job is started until it is finished, and this is an excellent plan.

I do not think Mr. Herbert thoroughly appreciates the value of a rate-fixing department. I should say it is an invaluable institution, even in works where day work is in use. In fixing rates for piece work or in fixing time allowances for which great care is necessary, it is indispensable. As a matter of fact, it should have the closest attention of a man who is able to appreciate the value of men and machines. It is also invaluable to a manager in bringing before him the time lost by nearly every machine for want of crane appliances, of jigs and fixtures, etc. The speed and feed of machines are also important items when looking where improvements can be made.

Mr. Herbert has made it evident throughout his article that to him there is nothing like piece work. For certain classes of work Mr. Taylor's system is a very good one, although I do not think it equals the system in use in our works, and I feel sure that if Mr. Herbert were to tackle the introduction of the premium system personally for, say, six months, to approach the subject with an open mind, he would at the end of that period be convinced that there is more in the premium system than he at present believes

In *The Engineer* of April 18 some diagrams drawn by Professor Barr, of this city, are given and are accompanied by a descriptive article to which Professor Barr has added some most excellent remarks.

JAMES ROWAN.

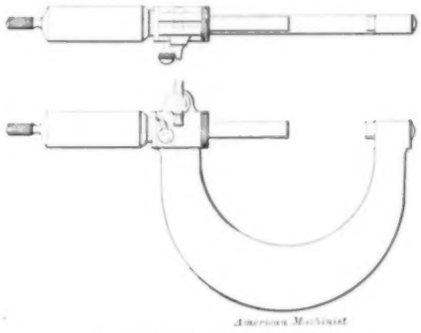
Glasgow, Scotland.

[So far as I know, no one on this side of the Atlantic expects to continue the old-time base when new methods of production are introduced. It is accepted as a matter of course that under these circumstances the rates must be revised and a new base time be determined.—F. A. H.]

A Micrometer Scheme.

Editor American Machinist:

The accompanying sketch shows a scheme for doing away with a number of parts in a set of micrometers. The set might run from 1 inch up to 12 inches. By fitting a binding bolt and nut to each frame, and cutting the slot in the end of



A MICROMETER SCHEME.

the hub, the micrometer head and spindle can be readily shifted from one frame to another.

C. W. PUTNAM.

Holyoke, Mass.

An Explosion.

Editor American Machinist:

We have had an accident in the shop, which puzzles me somewhat. We had a roll from a paper machine to repair. It was made from a piece of 6-inch pipe, about 7 or 8 feet long, with cast-iron heads in the ends and steel gudgeons driven into these heads. One of the these gudgeons was broken, and we drilled it out just before night, drilling 1¼-inch holes through into the inside. In the morning the foreman wanted to look into this hole, for some reason, and held a match to the hole, when there was a loud explosion, burning the foreman badly. Now, what puzzles me is, what could have been in this roll that would explode, especially after it had been open to the air about fourteen hours? If you can throw any light on this subject I should be very glad to have you do so.

E. M. CROSS.

[A mixture of illuminating gas and air could have exploded as described. We have no suggestion as to how the gas might have got into the roll. Chemicals

used in paper making might, we suppose, produce explosive gases under some conditions.—Ed.]

Water Supply and Drain for the Grindstone.

Editor American Machinist:

Twelve years ago I arranged a water supply and drain for a grindstone, which, while very simple, saved a great deal of time and trouble, and kept the stone always ready for use. The supply consisted of a ⅜-inch pipe coming up through the floor, with a valve beside the trough, from which a ¼-inch brass pipe led to a sprinkler, made by drilling a few 1-16 inch holes in a branch of the pipe over the stone. A lever cock was introduced just above the sprinkler, the valve referred to being adjusted to prevent any spattering when the cock was opened wide.

Under the floor was suspended a 20-gallon keg, into which a 1-inch pipe from the bottom of the grindstone trough, directly above, delivered the waste water and sand. The sand was trapped in the keg, and the water flowed off through a ¾-inch pipe near the top of the keg to a sink. The keg was hung low enough to permit the pipe from the stone to be cleared by pricking it from below. The apparatus is still in use.

More recently the same idea has been applied at the Mechanic Arts High School, in Boston, where there are two Brown & Sharpe troughs in the machine shop, two more of the same kind in the carpenter shop on the floor above, and two smaller ones in the turning shop on the third floor. The troughs of each pair are set close together, as shown in the cut, which is from a photograph of those in the carpenter shop. Water is supplied to each stone essentially as in the original plan described above. The trap, which is in the basement, consists of a 30-gallon galvanized iron tank, with a 1-inch round-way cock in the bottom to empty it, and two outlets, one near the top of the tank, and the other about a foot lower, both of ¾-inch galvanized pipe. The lower pipe connects directly with a sink trap, while the upper one drips into the sink itself. When the lower pipe becomes clogged, the upper one takes care of the water, but gives the alarm by its dripping.

The two stones in the machine shop drain through the floor directly into the tank. The other two pairs of stones drain through separate 1-inch brass pipes, made up without elbows, the arrangement at the stones being shown in the cut. A round-way stop-cock is placed just outside of each trough, from which the pipes enter a side-outlet cross (a railing fitting), from the lower side of which runs the waste pipe, with another cock just above the floor. The supply pipe, which is ¼ inch comes up beside the drain, and is connected through a tee and a union angle valve to the top outlet of the cross. The side outlet of the cross, which is plugged, is available for a clean-out.

By closing two of the stop-cocks either of the troughs or the drain can be thoroughly flushed. The supply pipe rises from the tee to the sprinklers, with a valve to control the supply and a ¼-inch lever cock over each stone. This apparatus has been in constant use for several years. The trap has to be emptied about once each year, and the lower outlet has had to be cleared once.

A. K. S.

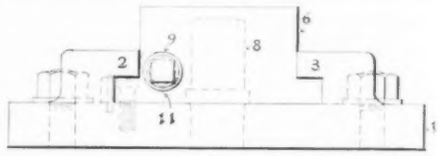


FIG. 1

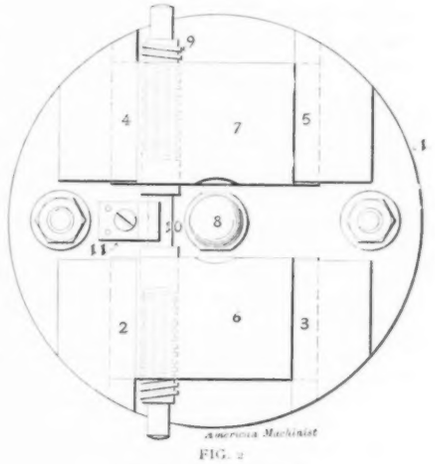


FIG. 2

PROFILING FIXTURE.

A Profiling Fixture.

Editor American Machinist:

I send herewith the drawing of a profiling machine fixture for bicycle fork-heads, which embodies a very efficient method of holding a casting or forging by jaws that grip the rough outside, the work being located centrally by means of a reamed hole and a stud on the fixture adapted to fit the hole.

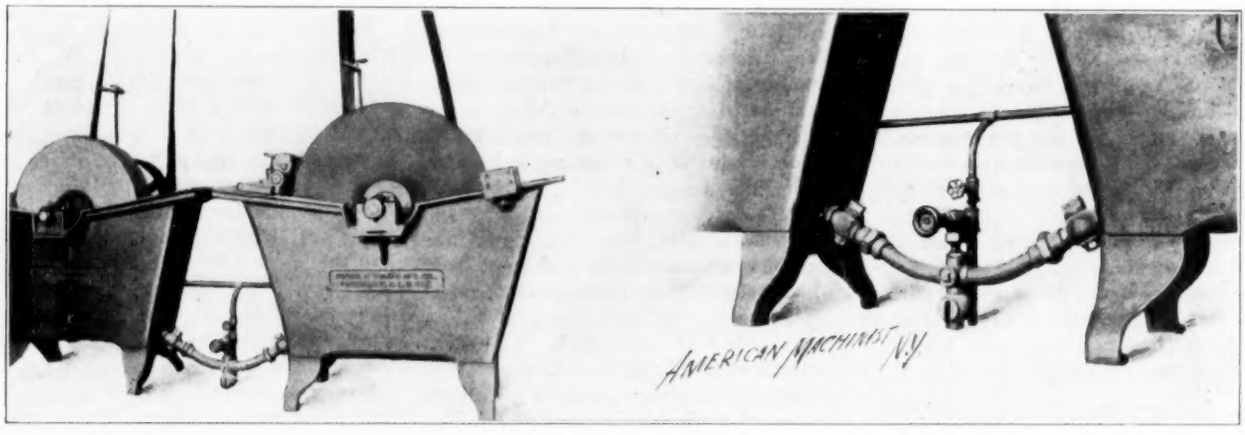
In the fork-head above mentioned the hole was first finished to size, and it was then necessary to profile the prongs to fit the side tubes of the fork, which were of elliptical cross-section, brazed on to the head in the finished fork.

Figs. 1 and 2 are respectively elevation and plan of the fixture.

The fixture consists of a cast-iron face-plate 1 bolted to the table of the profiling machine with a wedge-shaped plate intervening, which gives the desired angle to the prongs of the fork-head. Cast integral with the plate are the ways 2, 3, 4 and 5, in which travel the jaws 6 and 7, these being concaved to fit the middle portion of the fork-head. A stud 8 serves to centrally locate the fork-head after it has been drilled and reamed to sandard. The screw 9, having right- and left-hand threaded portions, serves to advance the jaws 6 and 7, being squared at the ends to receive a socket-wrench. The central part of the screw 9 is reduced in diameter for a distance of 1 inch at 10.

A block 11, which is ¾ inch wide, is screwed on to the plate 1 midway between the two jaws, so that the half-round part comes against the reduced center 10 of the screw. This allows the jaws 6 and 7 to adjust themselves to small eccentricities in the forgings of the fork-heads, and to both bear with the same pressure.

Brooklyn, N. Y. C. D. KING.



PIPING FOR GRINDSTONES.

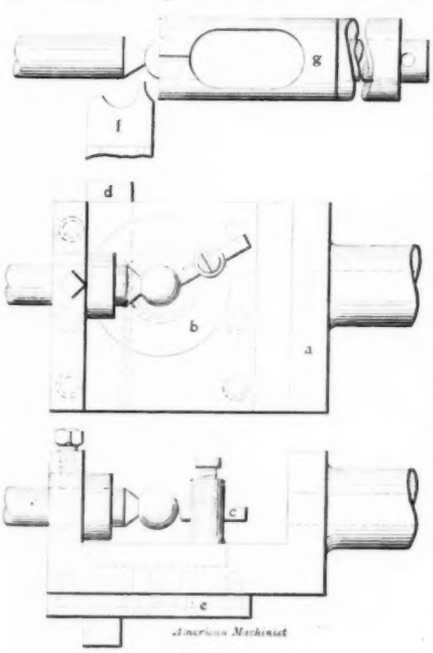
Turning Balls in the Screw Machine.

Editor American Machinist:

A large quantity of balls was wanted for a certain purpose, and it was found that those made on the automatic screw machine by the usual method—that is, with a forming tool made in a half circle—were not accurate enough to answer the purpose, so a special tool was designed that would turn a perfect sphere.

Referring to the sketch, *a* is the ordinary form of square box tool which is bored out to receive the turntable *b*. The turntable has a tool-post with the usual set-screw and is slotted to receive the tool *c*. On the under side of the pivot of the turntable is secured a spur gear and engaging with it is the rack *d*. The rack is held in place by the plate *e*, which also serves to cover the gear and prevent its filling with chips. When the rack is moved sideways it is obvious that it will cause the turntable to rotate, carrying the tool in a true circle, and it will of course turn any size of ball which the tool-post will clear.

The first operation is performed by a circular forming tool shown at *f*, which cuts off the finished ball and, continuing on, roughs out the next one on the end of the rod. The rod is now fed forward to a stop in the turret and the turning tool is swung around in place. The cam for this operation is set straight on the drum and merely brings the tool up to place and holds it stationary. As the tool is brought forward, a projection on the end of the rack *d* enters a slot in the dog clamped on the cross slide to receive it. The cross-slide is now moved slowly by its cam, drawing the rack and rotating the turntable and tool. The rack should be placed at the front end of the box as shown, so that the cut will be made by drawing the rack toward the back side of the machine. This will draw the tool slightly to one side, there being of course a little clearance between the stock and bushing; this clearance, however, should be very slight. When the cut is finished, the rack pushing the other way to return the tool into place will crowd the box to the front side; as this gives the tool a slight clearance on its return it does not leave a mark on the work.



BALL TURNING TOOLS.

If a particularly fine job is wanted, two of these tools should be used, the second taking a very light cut which will, of course, be uniform all the way around. To cut the ball off, a revolving spring holder *g* is used which grasps and supports the ball and allows it to be cut off without any burr. It is not necessary to provide an ejector for this holder, for the ball will be pushed back by the following one and drop out of the opening shown in the side.

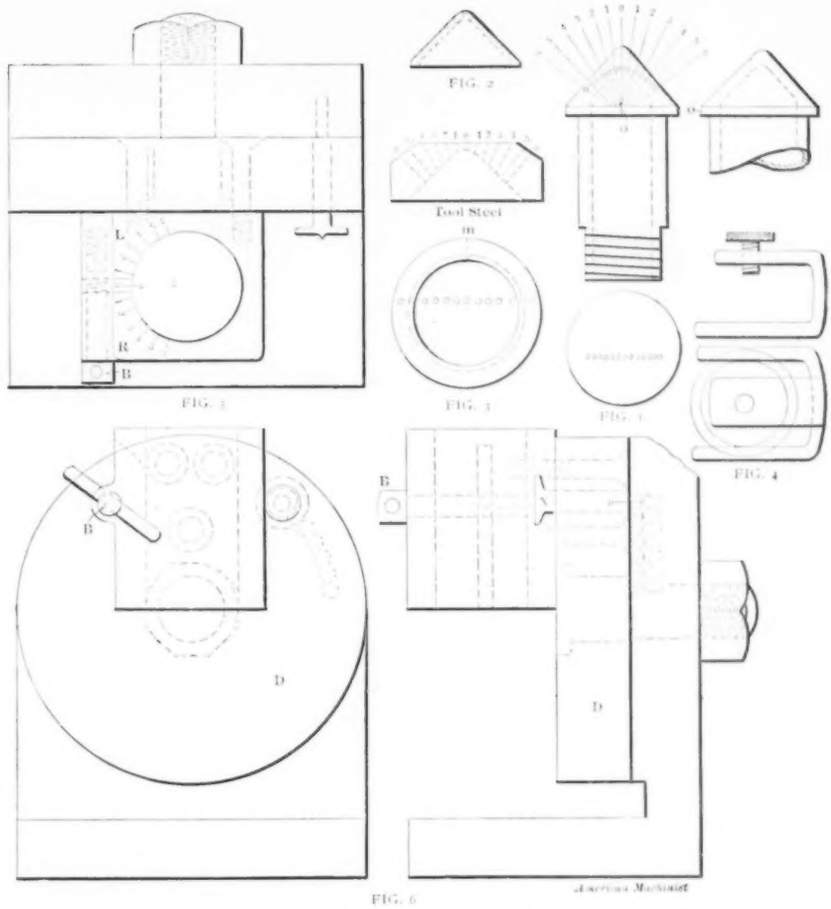
By using two tools, balls may be turned of machine steel fully as accurate as the ground balls, and if properly case-hardened and polished just enough to remove the tool marks, they make a ball superior to the tool-steel article; for, having a soft center, they will never split and a good case-hardening will penetrate deeper than the balls will ever be called upon to wear.

THEODORE.

Jig for Drilling a Nipple.

Editor American Machinist:

The accompanying drawings show a special nipple and the jig used for drilling it.



JIG FOR DRILLING NIPPLE.

While this jig may at first appear to be quite simple in design and construction, the writer thinks the results produced are quite out of the ordinary.

The piece drilled is the nipple of pump spout of hot-metal pot used on the Rogers typograph machine. The holes in the nipple are located so as to distribute the melted type metal instantly and evenly to all parts of the mold, or casting box, which casts the solid line of newspaper type; and it is important that it should be right, as the metal cools almost instantly when it strikes the inside of the mold.

Fig. 1 shows the nipple, and the location of the holes (thirteen in number made with No. 54 drill), and the reader will observe that to drill this piece with a fixed bushing would require some difficult curves, the methods for figuring which I am not on to. So I did it the best way I knew how, and as a boy can handle the job now without breaking drills, I feel satisfied.

In the old way of drilling, a templet and pair of dividers were used to lay out the position of the holes. The centers were punched good and deep, especially 0, 1 and 2, as the angle was so steep that it was no ordinary job to get the drill started where the operator wanted it. In drilling, the nipple was held in a vise which was tilted to suit each hole. The nipple was

tool steel and it cost quite a number of drills to get out a dozen of them.

The method of making the jig and holder was as follows: First a nipple was laid out very carefully with the bevel protractor and drilled, then the head of the nipple was cut off, as shown in Fig. 2. A tool steel cap, Fig. 3, was then turned out in the lathe, the cap being made to fit nicely over nipple head, Fig. 2. The two pieces were clamped together and the cap was drilled, the nipple being used as a jig. After hardening and lapping, the cap was completed and ready for use as a jig. It is fastened to the head of a nipple by the clamp shown in Fig. 4, and the whole thing is held by hand under a sensitive drill and each hole drilled, the nipple moved to 1 at the right and the opposite hole drilled. The disk is indexed to hole 2, and the operation repeated. The nipple has to be moved twice to each movement of the disk *D*. I do not know that this tool is mathematically correct, but do know that it does the business.

W. H. LEHMAN.

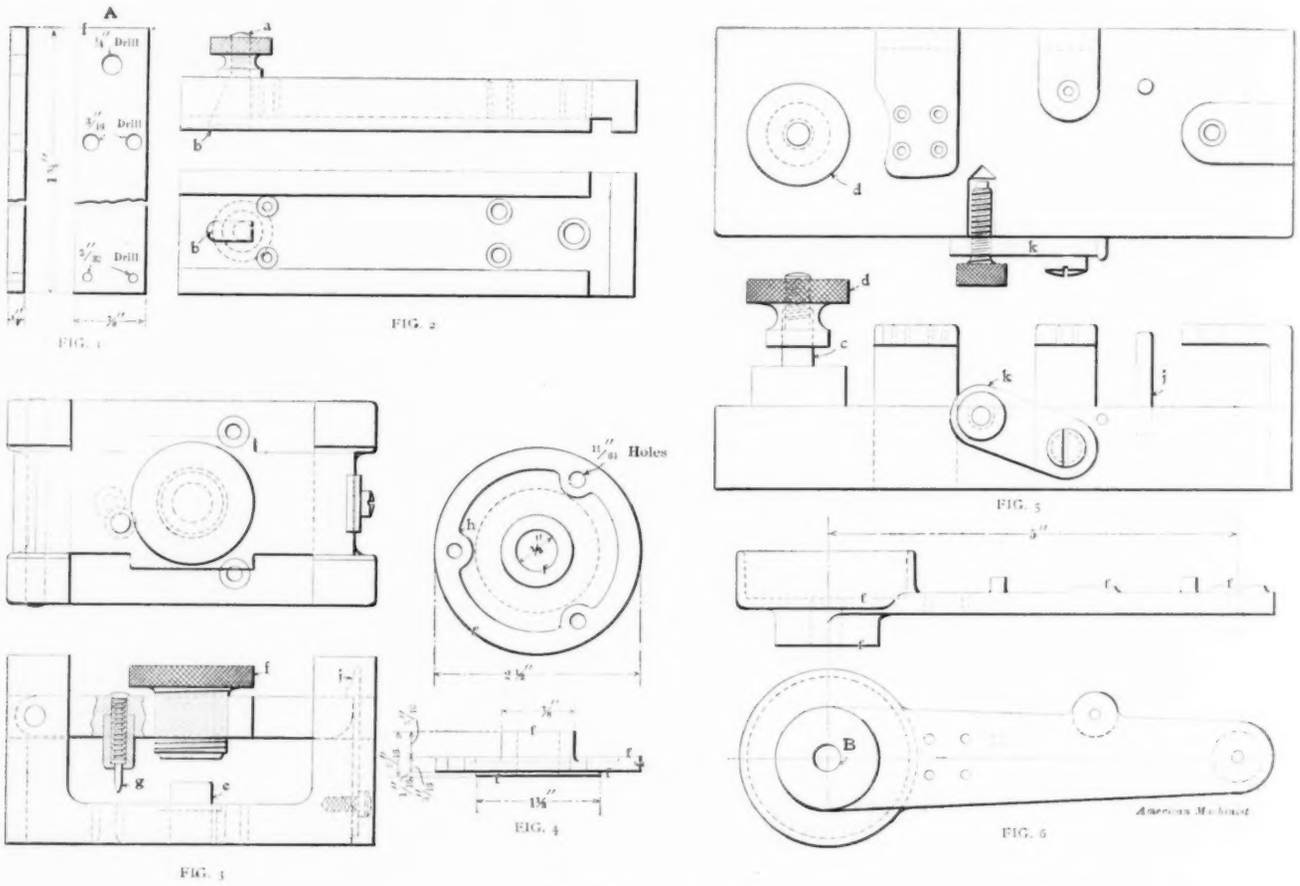
Some Small Drill Jigs.

Editor American Machinist:

The accompanying sketches show three drilling fixtures which, while not mechanically new, present some interesting points in the manner of securing the work to be drilled.

Fig. 1 shows a copper strip and Fig. 2 the same machine. The object of the fixture is simply to drill the three 11-64 inch holes in the small bosses around the rim. The casting is slipped into the jig on the center pin *e;* the cover is then closed, leaving the screw *f* free until the casting is turned around, allowing the spring plunger pin *g* to locate itself in a corner of any one of the three small lugs, as at *h*, Fig. 4. The spring snap latch *i* holds the cover, and the lock screw clamps the piece tight.

The fixture illustrated in Fig. 5 is designed for drilling the cast brass lever shown in Fig. 6. The center hole is first drilled and reamed and the faces machined in the turret lathe.



SOME SMALL DRILL JIGS.

spotted. All the nipples that are to be drilled go through this operation before being placed in the fixture shown in Fig. 6. At *M*, Fig. 3, is a mark at right angles with center hole, and as each nipple is spotted it is marked likewise. This line is used when locating nipple in fixture for finish drilling, the nipple being placed in the fixture with the mark on zero, and index pin *x* in 0, as shown in Fig. 6, binding screw *B*, holding nipple in place. In this position the first hole is drilled through, the binding screw is released and the nipple moved to point 1 at the left. Screw *B* is then tightened, the index pin is removed and disk *D* is swung until the index pin will go in hole 1. A hole is then drilled, and so on.

The fixture, which is made from a straight piece of cast iron, grooved to take in the piece; the working point is at *A*, Fig. 1, as the ¼-inch hole must be an exact distance from the finished end.

The clamping screw *a* is the novel feature. It is made from a piece of flat steel ¼x½ inch, tapered and rounded at the back edge and fitted in an elongated slot which is also made taper at *b*. A slight turn of the knurled nut clamps the piece to be drilled. This makes a cheap and simple jig.

Figs. 3 and 4 show a small drill jig and the piece to be drilled. This piece is a casting machined first in the turret lathe; the center hole is drilled and reamed in the fixture, which is made from a straight piece of cast iron, grooved to take in the piece; the working point is at *A*, Fig. 1, as the ¼-inch hole must be an exact distance from the finished end.

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The jig is built up of a cast-iron plate with steel angle pieces attached, to hold the bushings. The casting is located in the fixture on a pin *c*, which also carries the clamp nut *d*, the swinging clamp *k* with its screw, locating and holding the casting firmly against the stop-pin *j*.

D. E. MACCARTHY.

The Man Behind the Machine.

For the winning of industrial victories the man behind the machine is quite as essential as in naval warfare is the man behind the gun, and to the one is to be accorded the same proportion of credit for the work when well done as to the other. The value of the man is

perhaps as much shown by the failures and defeats which inevitably occur when he is absent as by the successes which are as sure when he is present and fully alert. We reproduce here a portion of an editorial from the *Indian Textile Journal*, published at Bombay, British India, which will be found well deserving of consideration. It not only suggests to us the industrial awakening and development and the perplexities and disappointments attending it in that interesting portion of the earth, but it states quite clearly one of the problems whose solution is still being sought throughout the industrial world. The writer says:

"At frequent intervals we meet the statement, both on the platform and in print, that a European training is the best course of instruction for Indian youths who have chosen their career among the industries, and, following this recommendation, young Indians are sent to England, to America, and elsewhere, and after a certain time they return full of the wonders they have seen, and keen to utilize their experiences. But where is the result? They may have worked hard, filled pocket-books with notes, and boxes with specifications and catalogs, yet when they return the same stumbling-block meets them all. All the machines, appliances and processes that worked so smoothly and with such magnificent results depended on certain qualities in the workmen in charge, and these qualities are the only things that could not be entered in a pocket-book or included in a specification of a plant. Is it automatic machines turning out pins, nails, screws, or stamped work, without apparent effort? There is unseen in the workroom in the factory the man whose wonderful skill provides the adjustment, and maintains the general efficiency of the tools whose work seems so simple. Is it the chemical processes, requiring the most careful adjustment of temperature, of strength of solutions, of boiling under pressure or vacuum or of absolute purity of materials? Workmen must be trained not only to know the processes but also to give that constant attention to their duties that alone can bring about the desired result. Suppose it is the exercise of one of the commoner handicrafts involving the use of machines producing articles that must be alike in many different parts, as in the case of mill bobbins; constant vigilance must be exercised to keep many parts in exact adjustment without which the cost of production eats up all the profit. Even in crafts that are exercised without machinery the same difficulty arises. The Indian youth has to leave the essential thing behind him, and he does not possess the faculty of training workmen, so we see very little result from the much belauded experiment of sending young Indians westward for their education, for the most important idea, the improvement of the Indian workmen, has been overlooked. A very great change must come over our native workman before imported industries can have a satisfactory chance of success, and in studying the training he should have it is esential that too great a change should not be attempted at once. The methods of work of Englishmen are in many cases so diverse from those of the Indian that no success has followed attempts to introduce them. The wheelbarrow offers a familiar example."

There can be no mistake in going on with our mechanical inventions, to make our machines still more automatic and to bring our methods still more to synchronize and co-operate; but when all is done that can be done we are still dependent upon skill and push and faithfulness in the men for ultimate results. We may sell our best machines and all we can of them wherever we can, and all the nations may reproduce and improve upon them, but not the best machines but the best workmen will still determine which shall be and continue to be the leading industrial nation, and the promise of the future is to that people which shall best develop its brains and its hearts, its skill and its will.

American Society of Mechanical Engineers' Program for the Boston Meeting.

The program for the spring meeting of the American Society of Mechanical Engineers, which is to be held in Boston from May 27 to 30, inclusive, has been sent out to the members. The headquarters of the society during the meeting will be at room 14, Engineering Building B of the Massachusetts Institute of Technology and the reading of papers and discussions will be in the same building. On Tuesday evening, May 27, at Huntington Hall, the society will be officially welcomed by Dr. Henry S. Pritchett, president of the Massachusetts Institute of Technology, and Mr. George A. Kimball, president of the Boston Society of Civil Engineers, the oldest engineering society in America. The first business session will be held on Wednesday, 10 A. M., for reports of tellers and committees and general business and the reading of professional papers. On Wednesday afternoon there will be a general visit to the various buildings of the Massachusetts Institute of Technology, with another professional meeting in the evening, and also on Thursday morning. On Thursday afternoon the members will visit the Atlantic Avenue Power Station of the Edison Electric Illuminating Company of Boston, and then go by steamer to the plant of the Fore River Ship & Engine Company, the trip giving a good view of the picturesque harbor. On Thursday evening a reception will be given to the society at the Museum of Fine Arts by the trustees and the local membership. For the closing session Friday morning the society will be the guests of Harvard University, and the meeting will be held in the lecture room of Pierce Hall. At the close of this session members of the society and ladies will be guests of the president and fellows of the University at lunch in the Harvard Union. President Elliot will make a short address. At this time will also occur in Sanders Theater the annual memorial services for the men of Harvard who died in the Civil War. Special entertainments are provided for the ladies for both Wednesday and Thursday, during the business session of the society, the first embracing a ride in the suburbs with lunch at Woodland Park Hotel, Auburndale, and the second another suburban ride connecting later with the steamer excursion down the harbor. A very enjoyable entertainment evidently has been planned, with much also to be learned.

Examination for Assistant Examiner.

The United States Civil Service Commission, Washington, D. C., announces that in view of an insufficient number of eligibles resulting from the examination held April 22 for the position of assistant examiner in the Patent Office at a salary of $1,200 a year, another examination for this position will be held at various places throughout the country June 17-18.

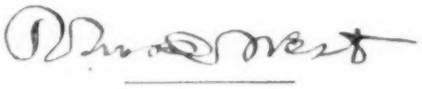
Piece Work in American Shops.

The way in which things sometimes get mixed up is well shown by a paragraph in the *Daily News*, of London. A contributor to that journal, speaking of the British employers, says:

"They will have to gain, or find foremen who have gained an intimate knowledge of the details of each kind of tool, and they will have to abandon the habit of cutting down the price of piecework directly any man goes beyond a certain wage. In the United States of America, the employer, having fixed what he considers a fair piece-work price, does not cut it down because a workman by superior ability or closer attention earns a high wage, but on the contrary adds a premium for the work done over what he considers a fair maximum output."

That piece-work prices are not cut here will be news to American shopmen.

At page 669 there was a note, relating to the proposed foundry trade school, by its most zealous advocate. The signature as printed was *John* D. West. It should have been as below:



Of the total cost of operating a locomotive, varying of course with locality and other conditions, the fuel cost is 36 per cent. and the wages of the enginemen are 30 per cent.

AMERICAN MACHINIST

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Foot Protectors for Foundry Workers.

The Association of Manufacturers of France against Accidents of Work last year started a public international competition to devise a covering to protect the feet and ankles of foundry workmen against burns. We gave a prospectus of this competition at page 844, Vol. 24. According to the program, this protector ought to fulfill the following conditions:

1. Effectually guard the feet and lower part of legs of the workmen against the flying melted metal.

2. Be easily and quickly put on and taken off.

3. Be adapted to different localities and customs, to different types of footgear, or constitute a complete footgear in itself.

4. Be cheap and sufficiently durable.

A prize of 1,000 francs might be awarded to the competitor holding the first place or be divided among the competitors.

We learn from a recent number of the *Genie Civil* that M. H. Mamy, director of the association, has presented to the Directory Council the report of the commission charged with the examination and tests of these protectors. Among the models offered by the eleven competitors the committee reserved only four to submit to the tests proposed. The characteristic elements of these devices are as follows:

M. C. Bouhard, chemist, of Paris, proposed gaiters knit of ordinary amiantus (mountain or earth flax, flexible asbestos) thread, nailed to wooden shoes, rendered fireproof, and held at the top of the calf, like stockings, by means of india-rubber bands.

M. E. Polidor, of Paris, offered a protector formed of a body of amiantus cloth doubled with a cloth of sufficiently large wire and nailed upon a galosh of fireproofed wood. The two cloths are sewed together only at the top, so as to leave between them a cushion of air. The body of the protector is split lengthwise like a gaiter and the two sides are held together with buttons.

M. A. Thomas, director of the foundries of Saint-Dizier, considered it necessary to condemn for founders the wooden shoe, the rising form of shoe, the heel and the leather upper. He proposed sandals combined with leggins. The sandals are of woven fireproof list and have shoes without heels. The leggins are of thin sheet metal with ankle joints; they are lined with leather and provided with two double buckles of steel.

M. A. Ledroit, foundry foreman, and Dr. Plicque, physician of the Compagnie du Nord, proposed a protector adapted indifferently to the various types of shoes worn in foundries. It is a gaiter fireproofed with silicate of potash. They consider, in fact, that the gaiters made from pieces of old carpet and which have long been employed in many foundries, have the advantages of being light, of little inconvenience and little expense. These have, however, two drawbacks. First, they do not offer sufficient resistance to the molten metal, which sometimes goes through them; second, they are not made or applied in the right way. The proposed gaiters, on the contrary, fireproofed with silicate of potash, will resist even when plunged in a crucible of melted copper.

To fix these gaiters in place, MM. Ledroit and Plicque employ Norwegian fastenings, which insure a good adaptation of the protector and permit of its being quickly removed. It is necessary especially that the gaiter be well fastened at the upper part, in order not to leave between it and the trousers any opening for the fluid metal, which would increase the gravity of the wounds. This danger may, however, be avoided and at the same time the stomach and legs be protected by wearing an apron of felt, also fireproofed. In regard to burns on the sole of the foot, much rarer than burns on the legs, they may be avoided by placing in the sole of the shoe between two layers of leather a piece of asbestos board or by frequently painting the sole inside and outside with silicate of potash.

The tests to which the various devices described have been subjected have led the commission to think that the gaiters of fireproofed carpet, presented by MM. Ledroit and Plicque, have the fewest objections and most advantages. Yet the commission has decided that there is not ground for awarding the full prize, and upon its recommendation the Directory Council of the association has given to these persons an honorary mention with the sum of 300 francs.

The Nine-Hour Day Movement.

At a special meeting held by the machinists' organization in Worcester on the 9th we learn that it was voted to strike on the 20th if the demands of the men are not granted before that time. As it is almost sure that these demands will not be granted and that in accordance with the agreed upon plan no notice will be taken of them, a strike will probably have taken place before this reaches our readers. Although efforts have been made by the men to bring about conferences regarding the questions in dispute we can learn of no instance in which such a conference has been granted and no manufacturer has signed the blank form of agreement submitted by the men. Additional members are being secured by the local branch of the I. A. M. at a rapid rate; many men who have not heretofore been identified with the organization being persuaded that as there is likely to be trouble it will be better for them to be in a position to take advantage of whatever protection the organization may afford its members.

One or two of the largest shops have not joined the Metal Trades Association,

but it is stated that they have agreed to stand by its principles and will refuse to recognize the I. A. M. in any manner. Some others prefer not to make any statement of their intentions and the feeling is strong on both sides that a trial of strength must be made sooner or later and may as well take place now as any other time. At the same time the feeling seems quite general among employers as well as the men that the nine-hour day will come sooner or later, though the employers believe that the wage question must be left to adjust itself by the process of individual bargaining. Some of the shops are in fact now shutting down Saturday afternoons and others will be pretty sure to follow.

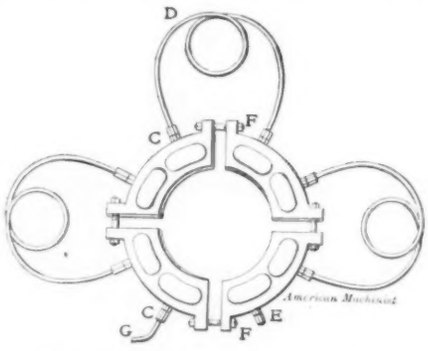
In Boston the men in some of the shops have also made demands.

Food riots are something Americans have not expected to see here for a long time to come, but they have taken place in New York because the people are convinced that prices are made artificially high by the operations of the packers' combine. It is somewhat curious that so much resentment should be aroused against the meat trust while at the same time the anthracite coal trust does pretty much as it listeth, with its control of anthracite mines and coal lands and of the railroads by which the coal must reach the market.

Some New Things.

HYDRAULIC PRESS FOR HUBS ON SHAFTS.

The device shown in the cut is made by Messrs. Young, of Birmingham, England, and is used for forcing propeller wheels off. It consists of segments which are bolted around the shaft, without necessarily fitting it, each segment having two oval pistons, all the pistons being forced out simultaneously by hydraulic pressure. The segments are only about 4 inches thick and may be used with any amount of backing. The pistons each act independently, so that they need not act



HYDRAULIC PRESS FOR HUBS ON SHAFTS.

against a true plane surface, ordinary casting surfaces being true enough. The press here shown is used on shafts from 6 to 18 inches diameter and exerts a maximum pressure of 450 tons. It may of course be used for forcing hubs on as well as off whenever there is something on the shaft to back against. In placing the device the pipes are left off until the segments are in place, when they can be quickly coupled on. A small hand pump is all that is required to supply the pressure.

FOR HARDENING ROTARY CUTTERS.

The cuts show an apparatus for hardening rotary cutters, especially thin milling cutters, saws and the like, to avoid warping, twisting or cracking by hardening only the teeth or cutting edges. The cutter *a* to be hardened is placed between two disks *b c* in a slightly conical vessel *d*, and in the hardening operation these are rotated altogether in a stationary vessel *e*. The vertical shaft *g* is driven from the bottom by a friction device, the pulling of the cord at the right applying the friction, while a release of the cord lets off the friction and allows the brake at the side of the friction disk to operate. The shaft passes up through a stuffing box which forms one of the bearings, and the disk *c* is fastened to it. The cutter is placed upon the disk *b* (see Fig. 2), which has a little side spring *p* that holds the cutter in place. The little

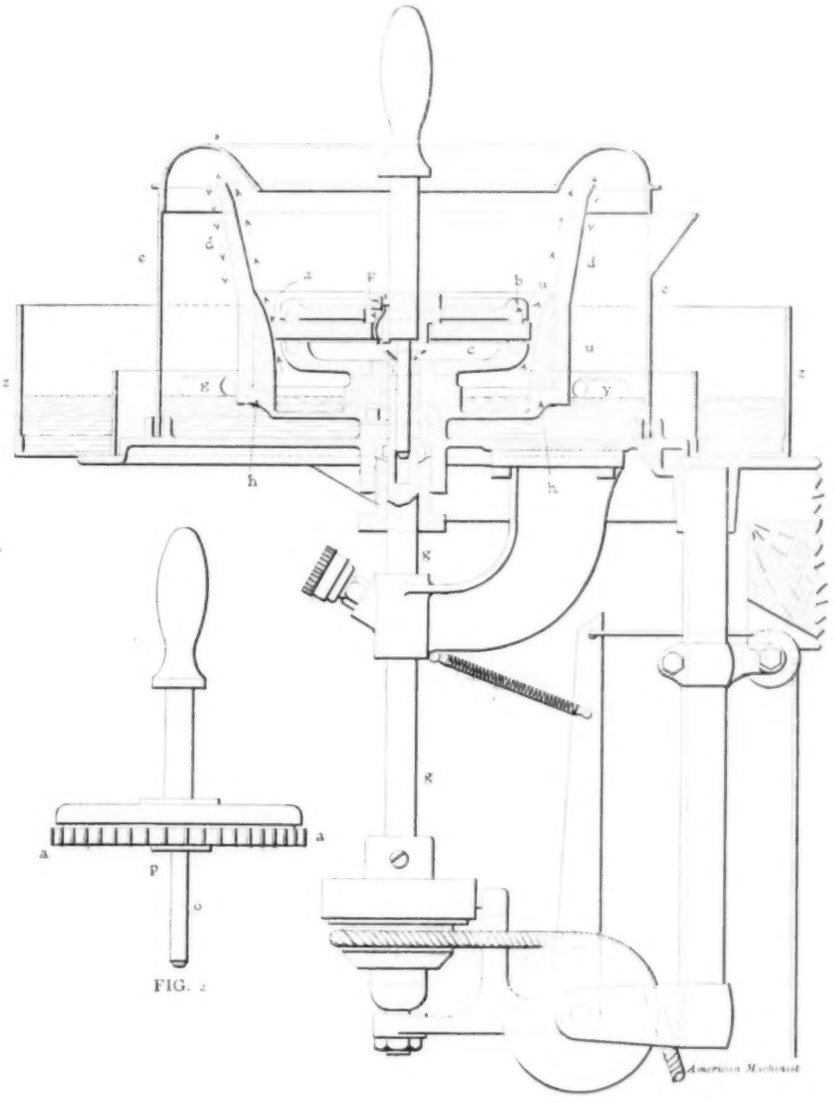


FIG. 1

FOR HARDENING ROTARY CUTTERS.

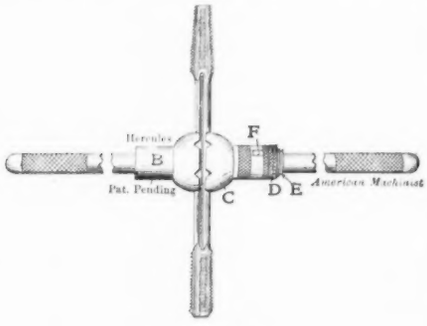
FIG. 2

stem *o* drops into a hole in the top of shaft *g*, and the cutter is then in place for the hardening. Asbestos packing *u* on each disk face prevents the cutter from being chilled. The bottom *h* of vessel *d* has large radial openings through which the liquid flows up from the vessel *e*, inclined lips helping to accelerate the movement. As the vessel *d*, with the cutter and other parts, rotates the liquid flows rapidly up through the thin annular passage *w*, thus rapidly cooling and hardening the cutter teeth. The liquid flows up over the top of *d* and drops down into *e* again to continue the circulation. There may be passages *y* connecting with an outer vessel *z* from which the liquid may be taken or into which it may be poured as required. The rapidity of the flow past the cutter teeth will vary with the speed of rotation and also with the depth of the liquid in the

tank. This apparatus is the invention of Henry Liebert, Perseverance Works, Milnrow, England, and it has been recently patented in the United States.

TAP WRENCH.

The cut shows a tap wrench made by the Robertson Manufacturing Company, of Buffalo, N. Y. On the handle *A*

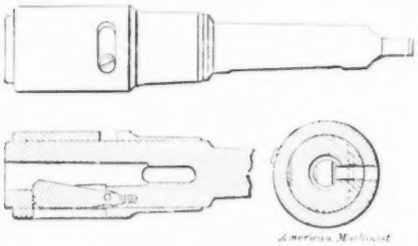


TAP WRENCH.

is pinned fast the jaw *B*. Jaw *C* is adjusted by means of the knurled nut *D*, which is carried on the threaded sleeve *E*. There are six squares or openings in the jaws—three different sizes. A pin *F* in jaw *C* keeps the jaw from turning when the tap is removed.

IMPROVED DRILL SOCKET.

The cuts show a recently patented drill socket. The socket has the usual taper hole with the elongated narrow slot for the end of the drill shank. On the side of the body of the drill socket is a slot extending through to the taper hole, and in this slot is a latch swinging on a small pin at the upper end with a little spring tending to move the latch into the taper socket. This latch fits into a longitudinal groove in the shank of the drill to assist in driving it or to prevent the drill from turning in the socket. The outside of the body of the socket is cylindrical and to it is fitted a long sleeve with a peripheral slot, and a headless screw in this slot and tapped into the body of the socket keeps the sleeve in place longitudinally and also limits its rotation. In this sleeve are two opposite slots which register with the drift



IMPROVED DRILL SOCKET.

slot in the socket. There is also on the side of the sleeve a slot corresponding with the latch slot in the socket, and these slots are so placed that when the sleeve is turned to the limit of its movement in one direction the slots in the socket will all be uncovered, and when it is turned in the other direction the slots will be closed. In this latter position the latch is locked into the drill shank and the drift slot is protected from an untimely insertion and use of the drift. When the sleeve is turned to uncover the slots the drift may be used and the drill may be changed. A little flat spring sunk into the solid side of the socket prevents the sleeve from rattling and also provides friction sufficient to keep it from turning. The inventor is Irving Barker, Springfield, Ill.

Technical Publications.

The publishing house Gauthier-Villars, 55, Quai des Grands-Augustins, Paris, has sent us a copy of its "Annuaire du Bureau des Longitudes" (Annual of the Bureau of Longitudes) for 1902. It is filled with tables and scientific information. Among the special articles this year is one on polyphase currents by A. Cornu, one on wireless telegraphy by H. Poincaré and one on the application of the decimal division of the quadrant to navigation, by M. Guyot. The book contains 850 3¾x6-inch pages and costs 1½ francs, postage extra.

"Nuttall Gearing." 81 4½x7-inch pages, with numerous illustrations and tables. R. D. Nuttall Company, Fayette street and Garrison avenue, Pittsburgh, Pa.

This volume has been prepared by its publishers for the use of their customers in ordering gearing. It contains in brief compass a large amount of information about gearing, of which we mention tables of the dimensions to be given in ordering spur, bevel, miter, worm and internal gearing; full sized illustrations of teeth of various diametral pitches, tables of equivalent diametral and circular pitches, formulas for gearing in diametral and circular pitches, rules for diameters and speeds of gears and pulleys, tables of diameter increments and angles of bevel gears, the strength of gear teeth by the Lewis formula, and reduction tables and constants for English and metric measures. At the end are appended tables of areas and circumferences, specific gravity of metals, weights of iron and steel in various forms and dimensions of standard screw threads.

"Cast Iron: A Record of Original Research." By W. J. Keep, 225 6x9-inch pages with 117 illustrations and 80 tables. Wiley & Sons, New York. Price, $2.50.

As is well known, Mr. Keep has been for many years an original investigator of cast iron and this book gives the record of his investigations and discoveries, together with related researches by others. Mr. Keep was the discoverer of the relation between the shrinkage and composition of foundry mixtures and he was the first to suggest the use of shrinkage tests in place of chemical analysis as a guide in makirg mixtures. His book is largely an exposition of the influence of silicon on foundry mixtures and of the methods of its control through the application of shrinkage tests. The author's apparatus for making such tests and his dead-load testing machine, his hardness-testing machine (described at page 225, Vol. 24) his impact-testing machine and his cooling curve recording machine, together with their uses, are fully described. The influence of carbon, silicon, phosphorus, sulphur and manganese have each a chapter, tables of tests and cooling curves being given in great profusion. The book is strictly practical and is intended as a guide for the foundryman in making his mixtures, the advantage of physical as compared with chemical tests lying largely in the fact that any intelligent man can make the former quickly and at trifling expense, while a chemist is required for the latter and his work involves much more time and outlay. There is not a page of padding in the entire book, which is extremely compact and arranged as a manual for every-day use. It will, no doubt, do much to improve foundry practice.

Personal.

N. L. Frothingham, patent attorney and counselor-at-law, has changed his New York address to 271 Broadway and his Boston address to 53 State street.

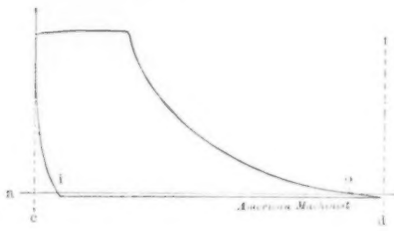
C. P. Wetmore, who for some time has been connected with the Russell & Erwin Manufacturing Company, of New Britain, Conn., as mechanical engineer, has resigned to become superintendent of the Comptograph Company, of Chicago.

Perhaps the most important quality is the ability and willingness to work hard. This does not necessarily mean an incessant grind from one year's end to another, but it does signify that one must be keen after his duties and not in the slightest degree inclined to shirk them. It is only by doing the work of the man ahead of you as well as your own that one can be promoted. It is almost always foolish to avoid responsibility. This is bound to come to one and it is impossible to dodge it.—*Prof. F. B. Crocker.*

The University of Wisconsin intends to conduct this season, from June 30 to August 8, a summer school for apprentices and artisans. The courses of instruction are in the use of formulas, mechanical drawing, steam engineering, applied electricity, transmission of power, strength of materials, and shop work in carpentry, forging and machine tools. A small fee is charged. The school was started last year and proved very useful. Information about it may be had from J. B. Johnson, dean of the College of Engineering, Madison, Wis.

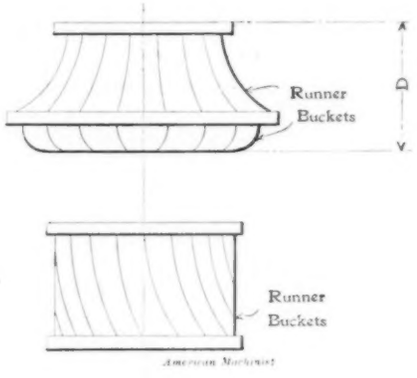
Questions and Answers.

Name and address of writer must accompany every question. Questions must pertain to our specialties and be of general interest. We cannot undertake to answer by mail.



(7) J. B. C., Philadelphia, asks: What is the displacement efficiency of a small belt-driven air compressor? A.—The displacement efficiency, or the volumetric efficiency, of any air compressor varies with the pressure at which the air is delivered, and the speed of the machine also affects the result. Only an indicator diagram will tell the story in a way to be relied upon. In the assumed diagram here shown, *c d* being the stroke, the volume of free air actually delivered will be indicated by *o i*, or, if *c d* indicates the full content of the portion of the cylinder swept by the piston, the volume actually delivered will be $\frac{o\,i}{c\,d}$. The diagram is purposely exaggerated, as the intake line is often indistinguishable from the atmosphere line, and compression then seems to begin at the beginning of the stroke, but we know that during the admission stroke the pressure must be lower in the cylinder than outside, or the air would not follow the piston and fill the cylinder. There must therefore be some portion of the stroke lost at the beginning until the pressure within the cylinder equals that of the atmosphere. The greater loss is usually shown at the other end of the stroke, where the air at the delivery pressure which fills the clearance space re-expands as the piston recedes. This failure to deliver is a reduction of the compressor capacity rather than of its efficiency. The actual volumetric efficiencies of the class of compressors inquired about probably never go above 95 per cent., while they more frequently go below 90 per cent.

(8) H. C. K., Watertown, N. Y., asks: (1) What advantage has a water turbine with a flared or bell-shaped bottom, like the Hercules, Smith-McCormick, Victor, etc., over one which is cylindrical, like the Alcott or Risdon—both as shown in the sketch? A.—The projection of bottom of bucket gives greater width of discharge aperture, which is much contracted vertically by the cycloidal form of bucket, and thus allows it to discharge all the water which it will receive at the top. One of the new type wheels of 30 inches diameter uses twice the water and gives twice the power of one of the old type. The Risdon Company adopted this idea in two of their patterns, the "L. C." and the "D. C.," or "larger" and "double" capacity, and these wheels come up close to the new type, which are probably on the whole most efficient. (2) Which type, other things being equal, would be the most efficient? A.—See above. (3) A turbine of given diameter and given area of discharge openings has a depth *D* (see sketch) of 30 inches and makes a given number of revolutions per minute; if another turbine of same diameter and same area of discharge openings has a depth *D* of but one-half the former, or 15 inches, how will the latter wheel compare with the former in regard to speed and power? A.—Turbines of the same diameter should revolve at the same speed, but the deeper the bucket, the more chance the water has to get in its full force, and will give the best results. (4) In what respect do the pitch and number of buckets in a turbine govern the speed and efficiency? A.—The pitch and number of buckets have no effect upon the speed. The greater the number of buckets the greater the loss by friction and the greater the liability to choke with ice and leaves. (5) Should the side of the bucket which comes in contact with the entering water be concave or convex? A.—It is not very material whether the receiving face of the bucket is slightly convex or concave; very good results are obtained from both forms—the Risdon is slightly convex; the Victor concave. (6) Should the speed of a turbine, in feet per minute, be measured at the rim or at a point midway between rim and hub, and what percentage of velocity does a running turbine bear to the theoretical velocity of the water, due to the head? A.—The speed of the turbine should be taken at the



center of discharge, say two-thirds to three-fourths of the distance outward from center of shaft, and this velocity, to get the best results, should be that of the "contracted vein," or 60 per cent. of the theoretical revolution. The answers to the above questions are by Samuel Webber, of Charlestown, N. H.

In 1877 the German Patent Office got on with only forty employees. To-day there are 729, and three large buildings are needed, with parts of four others.

The George Gorton Machine Company, of Racine, Wis., write us they are using a rubber stamp, like the fac simile here given with good results and which they thought perhaps others might be interested in. They find it very convenient for stamping inquiries for catalogs, etc., which are received daily and they use such a

CREDIT INQUIRY TO
"AMER. MACHINIST."

stamp also on requests sent to others for printed matter. Mr. Gorton adds, parenthetically, that the original of the impression given—that is, for the AMERICAN MACHINIST, shows by far the most wear of some six that are in use.

Commercial Review.

NEW YORK, Monday, May 19.

TOOL MARKET AND OTHER NOTES.

While there may be a few local signs of a decrease in the volume of business they are but trifling and the market on the whole is very strong and active. The outcome of the machinists' strike movement which will be brought to a head this week is by no means ignored, however, and the coal miners' strike is regarded pretty seriously in view of the effects which it will probably have on the machine-tool market if it amounts to much. Nevertheless the situation is so strong that advances are being made in the price of machinery. One very significant change took place about the first of May. It was an advance of 5 to 10 per cent., covering a varied line of tools which must have a material influence on the market in general. Advances in different kinds of machinery are reported to take place June 1 or sooner. We have heard of increases announced by a manufacturer of engines and boilers, for instance. Hydraulic presses in at least one case are being marked up.

Undoubtedly, it is at the door of the pig-iron market that the rising tendency of machinery values must be laid. The advance in castings has been something tremendous, and it is claimed that the cost of material alone is an adequate determinant for the change in finished products. This of course indicates that the upward movement has an impulse in heavy machinery, especially. The state of demand also permits if not induces it, a report in one important case being that deliveries are becoming more difficult every day.

While there are still some railroad machine tool deals pending in this market, the chief one that we have lately heard to be closed was a moderate batch of orders distributed by the Delaware, Lackawanna & Western Railroad for various shops on its lines.

Agricultural machinery is booming this year, to judge from the experience of the Minneapolis (Minn.) Threshing Machine Company. The company's first train load shipment of threshers this season was recently sent out and comprised forty cars. It was the biggest train load ever dispatched by this concern and is locally believed to be the biggest ever sent out by any threshing machine company in America. The load was valued at $150,000, all the goods being shipped on actual sales. They were bound for Oklahoma. The company is turning out the largest number of machines in its history. Last year's business amounted to $2,500,000, but this year's is expected to reach $3,000,000. The company will build a large boiler plant this summer and equip it with all modern appliances appropriate to its use.

Those who are attentive upon the final outcome of the steel-making industry situation brought about by the formation of the United States Steel Corporation will naturally watch with interest anything in the affairs of the concern which is acknowledged to be its chief American rival —Jones & Laughlins, Ltd. This firm, which is now capitalized at $20,000,000, will, it is said, shortly be incorporated with a stock of $50,000,000. So far from the change denoting an introduction of water into the company's finance, the actual value of the properties is said to be close to $100,000,000. In the estimates made on the big steel plants prior to the formation of the United States Steel Corporation it was rated at $85,000,000.

Mr. F. W. Horne, of Yokohama, has arrived in town and is making his headquarters with W. J. Kingsland, exporter, at 35 South William street. When seen on Friday he was busily engrossed on some large orders for machinery which he is placing and was preparing to start for a brief trip to Providence.

The American Roller Bearing Company, Boston, Mass., reports that owing to the unusually rapid growth of the business, deliveries have been much delayed and it has been compelled to decline heavy orders. The company, however, is extending its plant and installing much new equipment and has fitted up new offices, so that with the increased facilities it can give more prompt attention to orders.

The Emmert Manufacturing Company, Waynesboro, Pa., manufacturer of patent universal vises for woodworkers, has experienced a phenomenal growth in its business. In April the average number of vises ordered daily was 13, and for the past two months the orders have been from 250 to 350 every thirty days. It was necessary to put on a night force and add constantly to the equipment, but even so the company could not keep up with the demand for the vises. Offers to act as agent have come from France, Australia and elsewhere, and it has been found necessary to decline a number of them. The government navy yards, the great railroads and more than one thousand of the large wood-working shops of the United States use the Emmert vise and many have doubled and trebled their original orders. The company is now proceeding to erect a two-story annex 45x45 feet, which will double its output capacity, and it will be in the market at once for machinery with which to equip the same.

The Pittsburgh Reduction Company has secured 400 acres of land at Massena, N. Y., and will erect five large factories to cover at least fifteen acres. It will manufacture aluminum principally and will employ from 500 to 600 men. The cost of this plant will be over $1,000,000. It will use electrical power from the St. Lawrence.

The Chicago Pneumatic Tool Company reports that it has received as many orders during the first two weeks of this month as in any entire month since it started in business. There is a noticeable increase in orders from Germany, France and Great Britain.

Electrotypers and photo-engravers have been quick to see the advantages of electrically driven machines, and are installing electric motors in their plants as rapidly as occasion permits. One of the most recent plants to be thus equipped is that of the United States Playing Card Company, Cincinnati, Ohio, where all the electrotyping and photo-engraving machines are operated by the Sprague Electric Company's motors.

CHICAGO MACHINERY MARKET.

A large seller of machinists' supplies remarks that there is difficulty in procuring from factory prompt shipment of rough goods, like bolts and anvils, but that as a rule finished goods are making better deliveries. This is not the universal rule, however, for some of the latter are scarce. Some makers of twist drills have given notice that they can accept no more orders for special work, their shop capacities being occupied in turning out regular sizes. Since this order took effect the inquiry for special work seems to have increased rather than decreased. On the whole, the general market for machinists' supplies was never better in the West than it is now. The manager of one house says that only two or three years ago $8,000 would have been considered an excellent month's business by them. In April this year they did a business of $40,000, the largest total ever made in a month, and May promises to exceed April. Other sellers of supplies make reports of satisfactory trade.

Shop activities continue at pretty much their maximum levels. And the total consumption of machinists' supplies is enhanced by the equipment of a number of new shops. C. H. Besly & Co. note the fact that one feature of their present trade is the furnishing of machinists' supplies to new shops, both large and small. Of the latter there seems to be a large number starting up, not only in Chicago, but mainly throughout the West. It is a species of growth that has not been notable for some years, though a certain amount of it has been in progress all the while.

Giving the market a somewhat wider scope than only machinists' tools and supplies, there is noticeable in some quarters a lulling effect to current business. Within the past few days, or say last week, the general talk of Canal street has been that things are quiet. This may be only a temporary condition, for the consumption of material does not seem to have diminished perceptibly. About the only direction wherein an approach towards cessation is apparent is among some of the implement makers who are nearing the end of their natural season and are accordingly checking production. Scarcity of material, also, is contributing to a mod-

Machinery, Machines, and Parts of—	March— 1901 Number.	March— 1901 Dollars.	March— 1902 Number.	March— 1902 Dollars.	Nine Months Ending March— 1900 Number.	1900 Dollars.	1901 Number.	1901 Dollars.	1902 Number.	1902 Dollars.
Cash Registers	955	86,939	1,360	108,586	.....	613,269	9,232	738,206	9,356	813,504
Electrical Machinery	.....	561,433	.....	440,031	.....	2,906,031	.....	4,339,106	.....	3,096,101
Laundry Machines	.....	46,261	.....	45,174	.....	301,364	.....	324,299	.....	374,351
Metal-working	.....	250,019	.....	272,939	.....	5,389,444	.....	3,257,499	.....	2,399,690
Printing Presses, and parts of	.....	58,634	.....	56,022	.....	912,301	.....	837,662	.....	630,925
Pumps and Pumping Machinery	.....	183,079	.....	182,284	.....	2,351,060	.....	1,680,215	.....	1,576,402
Sewing Machines, and parts of	.....	316,440	.....	351,444	.....	3,328,348	.....	3,144,092	.....	2,860,379
Shoe Machinery	.....	83,092	.....	111,405	.....	885,196	.....	695,336	.....	786,681
Steam Engines, and parts of—										
Fire	1	625	1	3,150	1	8,135	11	18,470	9	24,456
Locomotive	32	249,288	50	408,386	394	4,095,534	315	3,077,453	286	2,510,896
Stationary	72	118,536	99	38,155	821	403,337	874	702,142	804	567,400
Boilers and parts of Engines	.....	96,666	.....	214,894	.....	1,235,906	.....	1,209,569	.....	1,286,204
Typewriting Machines, and parts of	.....	293,379	.....	302,742	.....	1,908,589	.....	2,078,000	.....	2,318,609
All other Machinery, and parts of	.....	1,201,866	.....	1,805,062	.....	15,945,475	.....	15,076,712	.....	14,902,807

UNITED STATES EXPORTS OF MACHINERY OF DOMESTIC MANUFACTURE, INCLUDING MARCH, 1902.

eration of activities in some directions. But there are compensations. The automobile industry, for example, is becoming steadily a greater factor in the machinists' supplies trade, orders from that source having been quite large during the past few weeks.

A. E. Delano is sold four months ahead in pulley molding machines and in general shop output.

The 250-kilowatt generator which the Electrical Equipment Company has just installed in the Chicago plant of Armour & Co. was sold some months ago. A recent notice in this column made it appear a more recent transaction.

Quotations.

NEW YORK, Monday, May 19.

Pennsylvania Foundry Pig Iron, Jersey City delivery:

No. 1 X	$20 15 @ $20 65
No. 2 X	19 65 @ 20 15
No. 2 plain	19 15 @ 19 65
Gray forge	18 65 @ 19 15

Alabama Pig, New York delivery:

No. 1 foundry, or soft	20 25 @ 20 75
No. 2 foundry, or soft	19 75 @ 20 25
No. 3 foundry	19 25 @ 19 75
Foundry forge, or No. 4	18 25 @ 18 75

Bar Iron—Base sizes—Refined brands, mill price on dock, 1.93 @ 2.03c. in carload lots. Smaller quantities from store, 2.10 @ 2.25c.

Tool Steel—Base sizes—Good standard quality, 7c.; extra grades, 10c. and upward.

Machinery Steel—Base sizes—From store, 2.10 @ 2.25c.

Cold Rolled Steel Shafting—Base sizes—From store, 2¾c.

Copper—Lake ingot, 12⅜ @ 12½c.; electrolytic, 12⅛ @ 12¼c.; casting, 12 @ 12⅛c.

Pig Tin—In 5- and 10-ton lots, f. o. b., New York, 30½c.

Pig Lead—4.10 @ 4.12½c. in 50-ton lots.

Spelter—New York delivery, 4.37½c. or a trifle more.

Antimony—Cookson's, 10 @ 10¼c.; Hallett's, 8¼c.; U. S., 8 @ 8⅛c.; various brands, 8c.

Lard Oil—Prime City, 81 @ 84c.

New Corporations.

Williams Deadlock Co.; object, making and dealing in electrically controlled clocks; capital, $500,000. President, W. A. Morgan, Portland, Me.; treasurer, E. O. Hiler, Boston, Mass.

Machinery, Rail & Metal Co.; principal office, 76 Montgomery street, Jersey City, N. J.; object, manufacturing rolling stock, etc.; capital, $100,000. Incorporators: Louis G. Morten, Walter J. Hamilton, Henry J. Melosh.

Empire Engineering Co. of New York, incorporated at Albany; capital, $500,000. Directors: Alwyn Van New, A. E. Kalb, M. P. Marks, H. J. Marks, Hammond Press and Malcolm Ryan, New York; Kenneth Kirtland, East Orange, N. J.

Puritan Motor Car Company; object, making and selling automobiles and other vehicles; capital, $135,000. President, Charles C. Smith; treasurer, Joseph B. Dow, both of Kittery, Me.

Phipps Road Car Co.; Principal office, Corporation Trust Co., 15 Exchange place, Jersey City, N. J.; capital, $1,000,000. Incorporators: Edw. H. Phipps, Herschel Parker and Frank A. Reynolds.

New Catalogs.

The C. H. Cowdrey Machine Works, Fitchburg, Mass., have sent us a catalog of woodworking and special machinery—back knife, gage and Weymouth or variety lathes, box machinery, saw benches, dowel machinery, etc. Size, 5¾x9 inches.

We have received a catalog of the Thomas S. Clarkson Memorial School of Technology, Potsdam, N. Y. This institution affords courses in civil, electrical, mechanical and domestic engineering, etc. The pamphlet is 6x9 inches, standard size.

The Allfree Engine Company, Indianapolis, Ind., has sent us two handsomely illustrated pamphlets relating to its automatic steam engines. These engines are described minutely, with specimen indicator cards, etc. The pamphlets are about 9¼x6 inches.

Wyman & Gordon, Worcester, Mass., have published in pamphlet form (4½x7 inches) a brief biography of Robert Fulton. They send us also another bit of literature relating to patent quick-action vises for wood workers, cabinetmakers and patternmakers.

The Sprague Electric Company, 527 West Thirty-fourth street, New York city, has sent us a copy of its 1902 catalog of Lundell fans and fan motors and of a pamphlet on Lundell motors for driving ventilating fans and blowers. Each pamphlet is 7x9¼ inches.

We have received from W. E. Caldwell Company, Louisville, Ky., a catalog (96 pages, 4¼x6 inches) of power-transmitting appliances, shafting, hangers, pulleys, couplings, friction clutches, pillow blocks, link belting, sprocket wheels, paper frictions, rope-transmission apparatus, etc.

Chandler & Farquhar, 36 Federal street, Boston, Mass., have published catalog No. 95 of tools and supplies for machinists, carpenters, electricians, amateurs, etc. It is the literary expression of a big and varied dealer's stock. The pamphlet contains 187 pages, 6x9 inches, standard size.

The Hersey Manufacturing Company, South Boston, Mass., has sent us a number of pamphlets, 8x13 inches in size, bound up like legal documents, describing different classes of apparatus which it manufactures. These relate respectively to the water works, steam drying machinery, sugar-house machinery, soap-works machinery and pneumatic malting machinery departments.

The Philadelphia Pneumatic Tool Company, Philadelphia, Pa., has brought out a new general catalog (9¼x6 inches) illustrating and describing its line of pneumatic tools—hammers for various purposes, rotary drills, yoke riveters, wood boring machines, foundry sand rammers and tampers for concrete and clay. There have been inserted tables of capacities, weights, dimensions, air consumption, etc.

We have received a catalog of the Cincinnati (O.) Punch & Shear Company, formerly the Wais & Roos Punch & Shear Company. The company is designer and builder of heavy power punching machines, coping machines, multiple punches, gate and universal shears, bending and straightening rolls, sheet doublers, rolling mill and tin mill machinery. These machines are furnished belt, engine or motor driven. The catalog is 6x9 inches, standard size.

The present competition between the central station and the isolated plant as a source of light and power for office and other buildings gives especial interest to the republication in pamphlet form of a paper on "The Economy of Isolated Electric Plants," by Isaac D. Parsons, from the *Engineering Magazine*. This edition is brought out by the Payne Company, builders of engines for isolated electric plants, 120 Liberty street, New York. The pamphlet is 6⅝x9⅜ inches.

The Buffalo Forge Company, Buffalo, N. Y., has brought out a tasteful little catalog describing the many different types and sizes of its portable blacksmiths', machinists', boilermakers', riveting and jewelers' forges, bench forges for light work, railroaders and prospectors: bellows, foot power, brazing and melting forges and folding forges for marine service. The pamphlet includes descriptions of the company's Buffalo hand blowers, power and hand drills, punches, shears, bar cutters, tire benders and tire upsetters. Size, 3½x6½ inches.

The Francis Reed Company, Worcester, Mass., successor to the Geo. Burnham Company, has sent us a catalog showing its line of manufactures, comprising upright drills for hand and power, sensitive drills with one to ten spindles, clamp-drills and planer chucks, upright nut tappers with two, three and four spindles. The post, bench and larger drills presented make quite an extensive line. We note among the machines a 16-inch tire-drilling machine, suspension drill, geared ratchet drills and a new track-drill. The catalog is 6x9 inches, standard size.

Pawling & Harnischfeger, Milwaukee, Wis., have sent us a pamphlet relating to their traveling electric hoists. These hoists travel on an easily installed straight or curved I-beam run-way and are adapted to either indoor or outdoor use; in the latter case the mechanism being protected with an iron cover and the operator's cage suitably housed. The use of an I-beam bridge is of value with these hoists and the bridge can readily be adapted to the transfer type to apply upon an entire plant. That the device is past its experimental stage appears from the partial list of users. The pamphlet is 10¾x7½ inches.

Manufacturers.

The Hygenic Blanket Company, Hubbardston, Mass., will enlarge its mills.

The St. Regis Paper Company will build a new pulp mill at St. Regis Falls, N. Y.

A. E. Jacobson will build a factory for the manufacture of iron beds in St. Paul, Minn.

The Zenith Portland Cement Company, Detroit, Mich., is erecting a plant at Grass Lake, Mich.

William Dolson, manufacturer of molders' tools, Canastota, N. Y., will soon erect a new factory.

The Holmes & Edwards Silver Company, Bridgeport, Conn., has let a contract to enlarge its buildings.

The A. Leschen & Sons Rope Company, St. Louis, Mo., is preparing to erect a factory and warehouse building.

The Katahdin Pulp & Paper Company, Bellows Falls, Vt., will erect a new sawmill in Lincoln, Me., this summer.

A one-story brick addition, 131x50 feet, is about to be built for James Barker, machinist and iron founder, Philadelphia, Pa.

The mill of the Sterling Paper Company, Hamilton, O., recently destroyed by fire, will be rebuilt at double its former capacity.

A new foundry building is in course of erection at the works of J. H. Newbury, manufacturer of pipe fittings, Goshen, N. Y.

A two-story factory, 232x40 feet, will be built at the works at Butler, N. J., of the American Hard Rubber Company, New York city.

The Fergus Sash & Door Company's factory, Fergus Falls, Minn., has been destroyed by fire. The company will probably rebuild at once.

The Oster Manufacturing Company, maker of adjustable die stocks, Cleveland, O., will erect a new factory building, 40x120 feet, two stories.

The Taylor Company, of Chicago, manufacturers of corn huskers and shredders (C. H. Taylor, manager), proposes to locate in Aurora, Ill.

Belmore & Ford, Colorado City, Colo., who recently sold out their bicycle business, are erecting a new building, where they will open a machine shop.

The Moffett Vehicle Bearing Company, manufacturer of anti-friction roller bearings, has moved its factory from Chicago, Ill., to Saginaw, W. S., Mich.

Adolph Kastor & Bros., New York city, are erecting an additional building at their cutlery factory at Camillus, N. Y. It will be 150x50 feet, three stories.

Work has been commenced on an addition to the works of the William H. Haskell Manufacturing Company, Pawtucket, R. I., manufacturer of bolts and nuts.

The Baltimore & Ohio Railroad Company has sent out plans and specifications for new shops and roundhouses at Connellsville, Pa., and Keyser and Fairmont, W. Va.

The Sullivan Machinery Company, Chicago, Ill., manufacturer of quarrying and mining machinery, has broken ground for another addition to its plant in Claremont, N. H.

The Standard Oil Company has purchased in Bayonne, N. J., 40 acres adjoining its plant. The oil plant at Constable Hook is to be extended. Additional stills, etc., will be built.

The North & Judd Manufacturing Company, New Britain, Conn., is about to erect two new buildings. One will be a brass foundry, 60x120 feet, for the finer grade of saddlery hardware.

The furnace capacity of the Duquesne steel works not being up to the rolling capacity, it has been decided by the Carnegie Steel Company to build two new open-hearth furnaces at a cost of $40,000.

Negotiations have been closed at Marquette, Mich., for the erection at Munising, Alger County, of a pulp and a paper mill. H. H. Everard, the paper manufacturer of Kalamazoo, is one of those interested.

The International Silver Company will build this summer for Factory P, at Wallingford, Conn., a two-story addition, 30x38 feet, and will increase its power equipment by the addition of a new 100 horse-power water wheel.

The Pittsburgh Gage & Supply Company, Pittsburgh, Pa., has been appointed direct representative of the Weller Manufacturing Company, Chicago, for its line of elevating, conveying and power transmitting machinery.

A large building of the plant of the Cumberland Glass Manufacturing Company, Bridgeton, N. J., has been destroyed by fire, throwing 250 men and boys out of employment. The burned factory will be at once rebuilt.

The Flickinger Iron Works, formerly of Cochranton, Pa., has been moved to Bradford, Pa., and incorporated, and will make a specialty of the manufacture of gas and gasoline engines. The firm name is Flickinger Iron Works.

A company has been incorporated at Osage, Ia., to be known as the Osage Manufacturing Company. Its purpose is the manufacture of articles of the woodworkers' trade, store fixtures, window sashes, etc. The erection of a plant is contemplated.

The United Barium Company, which makes barium nitrate, will, it is reported, build a factory this summer at Niagara Falls, and the recently organized Vermilion Chemical Company, it is understood, will shortly begin work on a factory there.

The Seelar Elevator Company, Pittsburgh, Pa., recently incorporated to succeed the Seelar Elevator Works, is having a five-story building erected at Seventh avenue and Fountain street, which will be equipped and ready for occupancy in November.

The Pittsburgh Valve & Fittings Company has just purchased several acres of land on the outskirts of Barberton, O., and will erect a plant. The plans call for eight buildings, the largest 450x60 feet, another 250x50 feet, and six others, all of them 200x40 feet.

The stockholders of the Tucapau (S. C.) Mills, cotton goods, have voted to build another cotton mill. It will be run by electric power, generated at Perry's Shoals, on Tyger River, about five miles away. It will be equipped with 30,000 spindles, 839 looms.

The Copake Iron Company, capital stock $50,000, and principal office at Copake, Columbia County, N. Y., has been incorporated. It is expected that work will be resumed in many of the abandoned ore mines in Northern Dutchess and Southern Columbia counties.

The Tidewater Steel Company, Chester, Pa., has made arrangements with the Suburban Gas Company to erect a factory adjoining the steel plant, which will be utilized by the company for a source of coke supply, thereby effecting an estimated annual saving of $75,000.

The Illinois Box Company, Alton, Ill., is preparing to start work on the power-house for a 500 horse-power electric plant, which will furnish electricity to operate the machinery of the box factory and electric fans throughout the plant of the Illinois Glass Company, also to light up the whole plant.

Work has begun on the foundation for the new plant of the Nevin Iron Work Company at Lowville, N. Y. The main building, which will contain the machine and wood-working shops, will be 35x126 feet. The foundry will be 35x91 feet. Two electric motors will furnish power, and $4,000 worth of new machinery has been purchased.

The Putney Brake Manufacturing Company, which has a factory at Toledo, O., has incorporated under the laws of Michigan, and will erect another factory at Monroe, Mich. The incorporators are Herbert Putney and E. H. Eckert, of Toledo, and Frank M. Peabody, of Monroe. The company is engaged in the manufacture of friction brakes, etc.

Waterloo, Ia., expects a factory to make gasoline engines and to employ not fewer than 200 men. The movers in the project are Thomas Cascaden, Jr., connected with the Davis Gasoline Engine Works, of that place, and G. B. Miller, of the Waterloo Gasoline Engine Company. It is intended to make the capital stock of the company $125,000.

The Slatington Textile Manufacturing Company, which recently located a silk mill in Slatington, Pa., operating 150 looms, has decided to increase the plant to 650 or 700 looms. They will also put in a lunch room, reading room and gymnasium, with baths, etc., for the employees. The power plant will be increased by an independent engine as an auxiliary.

There will, it is reported, be a new foundry at the Worcester Polytechnic Institute. Plans for the building are being drawn. It will be 80x50 feet, and will be equipped with the most modern appliances. The new building will relieve the pressure that has been put on the machine and forge rooms, and in both of these departments new and improved machinery will be added.

The new $150,000 plant of the Buffalo (N. Y.) Foundry Company will cover 6½ acres. The main building will be 320x145 feet. The foundry will be modeled after that of the General Electric Company at Schenectady. Councilman Charles F. Dunbar is president of the Buffalo Foundry Company. The new plant will give employment to about 300 and will have a daily capacity of 75 tons of castings. Two 30-ton cranes and four 10-ton cranes will form part of the equipment.

The Empire Portland Cement Company has decided to rebuild its plant at Warner, N. Y., and the Osborne Engineering Company, of Cleveland, Ohio, has been engaged to prepare the plans for the buildings. The rotary kiln system will be installed. The main building will be 235x70 feet wide; the power-house, 50x125 feet. The mixing room and machine shop, which were not destroyed by fire, will be reconstructed to conform with the style and general scheme of the new buildings.

The Pennsylvania Railroad Company is about to erect a number of buildings, etc., at Olean, N. Y., including a blacksmith shop, 50x170 feet, in which will be placed a 4,000-pound steam hammer; engine and boiler houses, planing mill, storehouses, a large transfer table to be operated by motor power and a coal wharf. The present machine shop and mill, separate buildings, are to be joined, making a machine shop 258x69 feet. The staff of help in the shops numbers about 450, and it is expected it will reach 600 before the summer has advanced very far.

Active operations in the building line are to begin at Niagara Falls as soon as the strike of the building tradesmen is over. The Castner Electrolytic Alkali Company may again add to its plant. The Carborundum Company is planning for an increase to its furnace rooms, the Oldbury Electro-Chemical Company is about to begin a structure which, when completed, will be a duplicate of its present plant and the Acheson Graphite Works will enlarge. Several new concerns have practically decided to come there. All but one are manufacturers of chemical products.

William A. Rogers, of Rogers, Brown & Co., and F. H. & C. W. Goodyear are proposing to build in Buffalo, N. Y., two 400-ton-a-day blast furnaces for the manufacture of foundry pig iron. An option has been secured on about 50 acres of land in the vicinity of the Stony Point steel plant, which will no doubt be chosen as the site. The company, which will be known as the Buffalo & Susquehanna Iron Company, will have its own ore properties in the Lake Superior district and coal mines of coking coal in Pennsylvania. The capital to be employed in the furnace plant, ore mines and coal operations is $3,000,000.

The American National Watch Company, capital stock $1,000,000, has been organized in South Bend, Ind., and proposes to erect a factory for making watch movements. This will comprise a 30x400-foot main building, a power-house and other buildings. Clement Studebaker, Jr., of Studebaker Bros. Manufacturing Company, South Bend, is president; E. A. Bazzett, of M. Bazzett & Co., Chicago, is manager, and W. W. Owen, of Columbus, O., will be superintendent of the factory. It is said that the new factory will probably be located at or near South Bend and that the enterprise includes the taking over of the watch movement business of the New Columbus Watch Company, Columbus, O.

Miscellaneous Wants.

Advertisements will be inserted under this head at 25 cents a line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Gear Wheels, gear cutting. Grant : see p. 18.

Punches & dies. Wal.M.Wks.,Waltham,Mass.

Caliper cat. free. E. G. Smith, Columbia, Pa.

Patterns and models. 19 Thames st., N. Y.

Ohio Township Officers Directory for 1902, now ready. R. S. Strader, Columbus, O.

Wanted—Improvements in grinding machinery. Address Box 1435, Providence, R. I.

Will buy or pay royalty for good patented machine or tool. Box 282, AMER. MACH.

Fine machine and experimental work. The Les Jardins Type Justifier Co., Hartford, Ct.

Light and fine mach'y to order ; models and elec. work specialty. E. O. Chase, Newark, N. J.

Light machine & experimental work : models made. S. Messerer, 15 Springf. av., Newark,N.J.

The Medart Patent Pulley Co., of St. Louis, Mo., machine shops destroyed by fire. Please send catalogs that will interest them.

Purchaser for complete sets of universal radial and plain upright drill patterns with drawings ; for sale cheap. Address "Patterns," care AMERICAN MACHINIST.

Contract work wanted for small foundry and machine shop, used to doing good work only ; operated by owner, member A. S. M. E. Address Box 469, AMERICAN MACHINIST.

Wanted—Gas engine, 25 to 40 H.-P. ; must be in first-class condition and reliable make ; state name, length of time used and best price f. o. b. Dayton, O. ; also want 10 or 12 in. belt. Address W. S. Hawker, Dayton, O.

Enterprise manufacturing engines, launches and will make automobiles, must have greatly increased facilities ; will employ at least 200 hands ; wish to receive proposition on change of location. Address Box 506, AMER. MACH.

Have several good inventions in shop tools bearing rigid investigation, having built same, but have not the money to patent and introduce ; want money as partner ; am practical machinist, daily at bench ; best of references. Box 480, AMERICAN MACHINIST.

Purchaser for small manufacturing plant in Madison, Wis. ; lot, 100x180 feet ; machine shop, 32x68, two story, with line shaft and gasoline power ; foundry, 40x54, new modern equipment ; good location ; for sale cheap. Hart-Parr Co., Charles City, Iowa.

Press work done at short notice ; blanking and drawing our specialty ; estimates cheerfully furnished ; tools for all work made on premises if desired ; copper, brass and nickel plating ; correspondence solicited. Acme Ball-Bearing Caster Co., Chappaqua, N. Y.

Wanted—Purchaser for small manufacturing plant ; brick buildings, machine shop, 30x100 ; foundry, 6 tons daily capacity ; blacksmith and wood-working shops ; everything fully equipped, complete with machinery, patterns, tools, cupola, boiler, engine, etc. ; if desired can guarantee yearly contract of $10,000 ; will sell for less than half original cost ; within 350 miles of Chicago or St. Louis. Address Box 510, AMERICAN MACHINIST.

For Sale—Valuable real estate and machine shop in the city of Biddeford, Maine ; the property known as the Hardy Machine Company, consisting of about thirty thousand (30,000) square feet of land, adjoining the track of the Boston & Maine R. R. ; large three-story machine shop and foundry, with first-class machinery and tools for manufacturing the Hardy card grinder, and other machinery ; the only general repair shop in this locality. For information apply to the President of the Company.

Wants.

Situation and Help Advertisements only inserted under this head. Rate 25 cents a line for each insertion. About six words make a line. No advertisements under two lines accepted, and no advertisements abbreviated. The cash and copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded. Applicants may specify names to which their replies are not to be forwarded ; but replies will not be returned. If not forwarded they will be destroyed without notice. Original letters of recommendation or other papers of value should not be enclosed to unknown correspondents.

Situations Wanted.

Foreman patternmaker, experienced on molding machines, desires position. Box 508, AMERICAN MACHINIST.

Machine shop foreman, of experience and ability, desires a change of locality. Box 507, AMERICAN MACHINIST.

Experienced mechanical draftsman wants position ; vicinity New York preferred. Box 489, AMERICAN MACHINIST.

Mechanical draftsman desires position ; experienced in machine tools and general machinery. Box 490, AMERICAN MACHINIST.

Experienced draftsman on heavy and light tools and wood-working machinery wants position. Box 497, AMERICAN MACHINIST.

Experienced man on automatic machinery ; 10 years' experience, designer, superintendent, engineer ; practical, educated ; references. Box 505, AMERICAN MACHINIST.

Expert mechanical draftsman, designer of machinery, rapid, accurate, wants position west of Cleveland, O., and north of the Ohio River. Box 515, AMERICAN MACHINIST.

Tool designer wants position ; expert at designing tools, jigs, fixtures, etc., for reducing the cost of manufactured articles. Wm. H. Flood, 308 W. 123d st., New York City.

Mechanical draftsman and machinist of broad experience, designer of tools, fixtures and special machinery, is open for engagement. Address Box 473, AMER. MACHINIST.

Position as superintendent or foreman, by up-to-date mechanic, thoroughly familiar with every detail of gas engine and automobile construction ; desires change. Address Box 491, AMERICAN MACHINIST.

Wanted—Position as superintendent of machine shop or manufacturing plant, by a man of experience in the manufacturing line ; first-class handler of men and up to date in shop practice. Address Box 496, AMER. MACH.

Machinist and toolmaker wishes to change ; experienced on punch and die work, jigs and fixtures ; 18 years' experience on all kinds of work ; would like a position with some manufacturing concern. Box 499, AMER. MACH.

Experienced superintendent in manufacture of high-class brass work, steam, water or sanitary specialties is now open for engagement ; can handle men and design tools for the rapid production of work. Address Box 495, AMERICAN MACHINIST.

Young man, 21 years old, desires to change and better his position, in a copper and brass or any other metal concern ; he is able to correspond in English and German and to do bookkeeping and entry work ; can give first-class references. Box 498, AMER. MACH.

Mechanical engineer desires correspondence with manufacturing company needing a man with extensive shop and drawing-room experience in design and manufacture of special, conveying and elevating machinery ; graduate mechanical engineer ; age 31 ; foreign experience erecting machinery. Address "Ahora," care AMERICAN MACHINIST.

Foreman desires position of responsibility with manufacturing concern, where a wide-awake young man with a successful experience on special and automatic machinery, engines, electrical apparatus, specialties and tools for interchangeable work will be appreciated ; energetic, capable and up to date in every respect. Box 501, AMERICAN MACHINIST.

Mechanical engineer with extensive experience in designing single and multiple-cylinder automatic engines for direct-connected and other high-class service, steam power and electric generating plants and general machinery, and superintending works manufacturing same, is open for engagement as superintendent, or in other engineering capacity. Address Box 513, AMERICAN MACHINIST.

Mechanical engineer, widely experienced, inventing and constructing labor-saving, intricate automatic machinery, devising special processes, etc., may be engaged for temporary or permanent work ; technical graduate ; member A. S. M. E., etc. ; advertiser will not work for less than $500 per month, but guarantees satisfaction and results in anything he undertakes. Box 429, AMERICAN MACHINIST.

Help Wanted.

Foreman, competent and energetic, for electrical machine shop. Box 494, AMER. MACH.

Die-sinkers wanted, accustomed to drop forged work. The Kilborn & Bishop Co., New Haven, Conn.

Wanted—A number of good patternmakers. Call or address De Laval Steam Turbine Co., Trenton, N. J.

Wanted—Two good, all-round patternmakers ; state experience and wages. Columbus Iron Works Co., Columbus, Ga.

Wanted—All-round machinist ; one used to gear cutting preferred. Boston Gear Works, 152 Purchase st., Boston, Mass.

Wanted—2 or 3 good, all-round machinists, in Detroit, Mich. Address, with references, Box 440, AMERICAN MACHINIST.

Wanted—Several good patternmakers, by a machine tool manufacturing works in Jersey. Box 179, AMERICAN MACHINIST.

Machinists—First-class, all-round mechanics ; also floor hands. Bullock Electric Manufacturing Co., Cincinnati, Ohio.

Wanted—First-class tool and die makers ; up-to-date factory located in central Pennsylvania. Box 512, AMERICAN MACHINIST.

Experienced draftsman on Corliss engines, also one on general machinery ; give full statement of experience. Box 476, AM. M.

A first-class man to erect paper cutters and bag machinery. Apply, giving experience and wages expected, Box 502, AMER. MACHINIST.

Wanted—First-class tool and die makers ; only those thoroughly up to date on this class of work need apply. Address Box 477, A. M.

Wanted—Foreman for a machine shop doing engine and general repairs and heavy manufacturing. George Smith, 72 Park av., Chicago.

Wanted—Good patternmaker on small engine and pump parts ; large Western city ; steady job ; open shop ; give references. Box 500, AMERICAN MACHINIST.

Draftsman with experience in making tools and fixtures for manufacturing rifles ; shop located in Connecticut ; state age, experience and salary. Box 509, AMER. MACHINIST.

Traveling salesmen, East and West, in dies, presses and a full line of can-making machinery, special and sheet metal working machinery. Address Box 488, AMER. MACH.

A good molder or all-around foundry man to work on floor and act as foreman ; a good, sober man wanted by firm in Zacatecas, Mexico. All information given by Box 493, A. M.

Wanted—Two of the very highest grade patternmakers, to work on machine tool work for highest pay ; shop 100 miles from Chicago ; married men preferred ; steady work to right men. Address Box 503, AMER. MACH.

Wanted—First-class patternmaker as foreman of large valve and flange fitting pattern room ; must be capable of taking charge of both wood and metal pattern work ; state age, experience and salary wanted. Box 471, A. M.

Wanted—Two or three first-class mechanical draftsmen to work on dredges, steam shovels, railroad wrecking cranes, etc. Apply, with statement of age, experience and references, to The Bucyrus Company, South Milwaukee, Wis.

Machinists wanted to act as shop agents and sell small tools where they work ; send 44 cents for 6 in. tempered scale, No. 4, warranted ; shall give a gold watch to some good agent. E. H. Randall, 235 Woodlawn ave., Springfield, Ohio.

We are enlarging our works, and will shortly require an increased number of skilled mechanics ; we invite application from pattern makers, molders and machinists. Address the Westinghouse Machine Company, East Pittsburgh, Pa.

Wanted—A thoroughly experienced and trained chief draftsman familiar with Corliss and high speed engines and competent to take charge of the drafting room of an active, working establishment. Address XX, care AMERICAN MACHINIST.

Practical machinist wanted by a well-established firm in Zacatecas, Mexico ; an all-around man who can do drafting when necessary and act as foreman ; a good opportunity for the right man ; age 28 to 40. Box 492, AMERICAN MACHINIST.

Wanted—Foundry foreman for shop employing about 40 molders ; heavy and light engine work ; jacketed cylinders up to 36 inches ; permanent position ; good salary and prospects for right man. Address C. A. F., care AMERICAN MACHINIST.

Wanted—Thoroughly competent foreman on machine tool building, experienced in building pipe threading machinery, familiar with methods of producing duplicate parts on turret lathes ; give age, experience, salary expected and references. Box 237, AMER. MACH.

Wanted—First-class steam-fitter, thoroughly posted on high and low pressure work and general piping for manufacturing plant ; must be sober and reliable, able to handle men, make sketches and lay out work ; state age, pay expected and references. Address Box 514, AMERICAN MACHINIST.

Reputable firm, of Cleveland, Ohio, wants a machine builder that can build most any kind of special machinery, that can make his own drawings, work himself and instruct his helpers to work after his own drawings ; good salary paid, but state how much you want. Box 504, AMERICAN MACHINIST.

Wanted—Competent machinist or blacksmith who can command $1,500 or $2,000, to take half interest and join foundryman in purchasing a thoroughly equipped foundry and machine plant that is now being offered very cheap in a thriving Western city ; young man preferred. Address Box 511, AM. MACH.

Wanted—Competent machine and floor hands ; heavy machinery ; piece work ; wages from $3 to $5 per day ; ten-hour shop ; only

sober, steady and competent men wanted; have had no strike or labor trouble. Address, stating experience, references and whether union or non-union, "Foreman," care AM. M.

A company manufacturing electric railway materials and located in north central Ohio, requires an assistant to the superintendent; must be familiar with shop practice and methods and capable of handling men; applicants should be between 28 and 35 years of age and able to furnish references. Address, stating age, previous experience and salary required, "Assistant Superintendent No. 18," care AMERICAN MACHINIST.

Wanted.—Machinists, toolmakers, draftsmen, do you want to increase your salary? They all say that Saunders' enlarged edition "Hand Book Practical Mechanics" exactly fills the bill for valuable shop kinks, rules, etc., figured out by simple arithmetic and drawings; also most complete reference tables in existence, many taken from note books of best mechanics in the country. Pocket size. Price, post paid, only $1, cloth; $1.25 leather. Agents wanted. Book sells itself. Big money. C. H. Saunders, 216 Purchase st., Boston, Mass.

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Arbor Press

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Bartlett, E. E., Boston, Mass.

Bails, Steel

Automobile & Cycle Parts Co., Cleveland, O.
Grant Tool Works, Franklin, Pa.

Ball Bearings

See Roller Bearings.

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Cleveland Twist Drill Co., Cleveland, O.
Underwood & Co., H. B., Philadelphia, Pa.

Bearing Metal

Phosphor Bronze Smelting Co., Philadelphia, Pa.

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Dixon Crucible Co., Jos., Jersey City, N. J.

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Shultz Belting Co., St. Louis, Mo.

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Diamond Drill & Mach. Co., Birdsboro, Pa.

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Bement, Miles & Co., New York.
Watson-Stillman Co., New York.

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Henley & Co., N. W., New York.

Boring and Drilling Machines, Horizontal
Barnes Co., B. F., Rockford, Ill.
Barnes Co., W. F. & John, Rockford, Ill.
Beaman & Smith Co., Provi., R. I.
Bement, Miles & Co., N. Y. City.
Betts Mach. Co., Wilmington, Del.
Binsse Macn. Co., Newark, N. J.
Dallett & Co., Thos. H., Phila., Pa.
Detrick & Harvey Mach. Co., Baltimore, Md.
Fosdick & Holloway Mach. Tool Co., Cincinnati, O.
Franklin Mach. Wks., Phila., Pa.
Jones Fdry. & Mch. Co., W. A., Chicago, Ill.
Newton Mach. Tool Wks., Philadelphia, Pa.
Niles Tool Works Co., New York.
Pond Mach. Tool Co., New York.
Pratt & Whitney Co., Hartford, Conn.
Warner & Swasey Co., Cleveland, Ohio.

Boring and Turning Mills
Am. Tool Wks. Co., Cincinnati, O.
Baush Mach. Tool Co., Springfield, Mass.
Bement, Miles & Co., New York.
Betts Mach. Co., Wilmington, Del.
Bullard Mach. Tool Co., Bridgeport, Conn.
Hill, Clarke & Co., Boston, Mass.
Niles Tool Works Co., New York.
Pond Mach. Tool Co., New York.
Warner & Swasey Co., Cleveland, Ohio.

Carborundum
See Grinding.

Castings, Brass and Bronze
Christensen Engineering Co., Milwaukee, Wis.
Nolte Brass Co., Springfield, O.
Phosphor Bronze Smelting Co., Philadelphia, Pa.

Castings, Die Molded
Franklin Mfg. Co., Syracuse, N. Y.

Castings, Motor
Herodowill & Co., J. H., St. Paul, Minn.

Castings, Steel
Acme Steel & Mall. Iron Works, Buffalo, N. Y.
Christensen Engineering Co., Milwaukee, Wis.
Uniform Steel Co., Newark, N. J.
U. S. Steel Co., Everett, Mass.

Centering Machines
Bement, Miles & Co., New York.
Kempsmith Mfg. Co., Milwaukee, Wis.
Niles Tool Works Co., New York.
Pond Mach. Tool Co., New York.
Whiton Machine Co., D. E., New London, Conn.

Centers, Planer
Fay & Scott, Dexter, Me.
New Haven Mfg. Co., New Haven, Conn.
Pratt & Whitney Co., Hartford, Conn.
Reed Co., F. E., Worcester, Mass.

Chains, Driving
Automobile & Cycle Parts Co., Cleveland, O.
Boston Gear Works, Boston, Mass.
Bridgeport Chain Co., Bridgeport, Conn.
Jeffrey Mfg. Co., The, Columbus, Ohio.
Link Belt Engr. Co., Phila., Pa.
Whitney Mfg. Co., Hartford, Ct.

Chucking Machines
Cleveland Mach. Screw Co., Cleveland, O.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
Potter & Johnston Mach. Co., Pawtucket, R. I.
Pratt & Whitney Co., Hartford, Conn.
Reed Co., F. E., Worcester, Mass.
Warner & Swasey Co., Cleveland, Ohio.
Windsor Mach. Co., Windsor, Vt.

Chucks, Drill
Almond, T. R., Brooklyn, N. Y.
Brown & Co., R. H., New Haven, Conn.
Cleveland Twist Drill Co., Cleveland, O.
Goodell-Pratt Co., Greenfield, Mass.
The E. Horton & Sons Co., Windsor Locks, Conn.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Pratt Chuck Co., Frankfort, N. Y.
Standard Tool Co., Cleveland, O.
Trump Bros. Mach. Co., Wilmington, Del.
Whitney Mfg. Co., Hartford, Ct.
Whiton Mach. Co., D. E., New London, Conn.

Chucks, Split
Faneuil Watch Tool Co., Boston, Mass.

Chucks, Lathe
Cushman Chuck Co., Hartford, Ct.
Hoggson & Pettis Mfg. Co., New Haven, Conn.
The E. Horton & Sons Co., Windsor Locks, Conn.
Pratt & Whitney Co., Hartford, Conn.
Skinner Chuck Co., New Britain, Conn.
Westcott Chuck Co., Oneida, N. Y.
Whiton Mach. Co., D. E., New London, Conn.

Clutches, Friction
Caldwell, Son & Co., H. W., Chicago, Ill.
Eastern Mchry. Co., New Haven, Conn.
Faneuil Watch Tool Co., Boston, Mass.
Jones Fdry. & Mch. Co., W. A., Chicago, Ill.
New Haven Mfg. Co., New Haven, Conn.
Oesterlein Mach. Co., Cincin., O.
Patterson, Gottfried & Hunter, Ltd., New York.
Pratt & Whitney Co., Hartford, Conn.

Compressors, Air
Blanchard Mach. Co., Boston, Mass.
Chicago Pneumatic Tool Co., Chicago, Ill.
Christensen Engineering Co., Milwaukee, Wis.
Clayton Air Compressor Works, New York.
Curtis & Co. Mfg. Co., St. Louis, Mo.
Ingersoll-Sergeant Drill Co., New York.
Rand Drill Co., New York.

Codes
Lieber Code Co., New York.

Consulting Engineer
Thompson, Hugh L., Waterbury, Conn.

Coping Machines
Long & Allstatter Co., Hamilton, Ohio.

Correspondence Schools
See Schools, Correspondence.

Countershafts
Builders' Iron Fdry., Provi., R. I.
Oesterlein Mach. Co., Cincin., O.
Pratt & Whitney Co., Hartford, Conn.
Reeves Pulley Co., Columbus, Ind.
Wilmarth & Morman Co., Grand Rapids, Mich.

Couplings, Shaft
Cresson Co., Geo. V., Philadel., Pa.
Davis Mach. Co., W. P., Rochester, N. Y.
Jones Fdry. & Mch. Co., W. A., Chicago, Ill.
Patterson, Gottfried & Hunter, Ltd., New York.
Stuart, R. J., New Hamburg, N. Y.

Counting and Printing Wheels
Franklin Mfg. Co., Syracuse, N. Y.
Grant Mfg. & Mach. Co., Bridgeport, Conn.

Cranes
Brown Hoisting Mach. Co., N. Y. City.
Chicago Pneumatic Tool Co., Chicago, Ill.
Cleveland Crane & Car Co., Cleveland, O.
Curtis & Co. Mfg. Co., St. Louis, Mo.
Franklin Portable Crane & Hoist Co., Franklin, Pa.
Maris Bros., Philadelphia, Pa.
Moyer & Co., J. W., Philadel., Pa.
Niles-Bement-Pond Co., New York.
Northern Engineering Works, Detroit, Mich.
North Penn. Iron Co., Phila., Pa.
Pawling & Harnischfeger, Milwaukee, Wis.
Sellers & Co., Wm., Philadel., Pa.
Whiting Foundry Equipment Co., Harvey, Ill.

Crank Pin Turning Machines
Underwood & Co., H. B., Philadelphia, Pa.

Crucibles
Dixon Crucible Co., Jos., Jersey City, N. J.

Cupolas, and Ladles, Foundry
Northern Engr. Works, Detroit, Mich.
Obermayer Co., S., Cincinnati, O.
Whiting Foundry Equip. Co., Harvey, Ill.

Cutters, Milling
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Twist Drill Co., Cleveland, O.
Gay & Ward, Athol, Mass.
Ingersoll Milling Mach. Co., Rockford, Ill.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Rogers, John M., Boat, Gage & Drill Works, Gloucetser City, N. J.
Standard Tool Co., Cleveland, O.

Cutting off Machines
Bement, Miles & Co., New York.
Davis Mach. Co., W. P., Rochester, N. Y.
Franklin Mach. Wks., Phila., Pa.
Hurlbut-Rogers Mach. Co., South Sudbury, Mass.
Newton Mach. Tool Wks., Philadelphia, Pa.
Niles Tool Works Co., New York.
Pond Mach. Tool Co., New York.

Cutting off Tools
Armstrong Bros. Tool Co., Chicago, Ill.
Pratt & Whitney Co., Hartford, Conn.

Dies, Sheet Metal
Bliss Co., E. W., Brooklyn, N. Y.

Drawing Boards and Tables
Rich, J. & G., Philadelphia, Pa.

Drawing Instruments
Alteneder & Son, Theo., Philadelphia, Pa.

Drilling Machines, Bench
Barnes Co., W. F. & John, Rockford, Ill.
Pratt & Whitney Co., Hartford, Conn.

Drilling Machines, Boiler
Aurora Tool Works, Aurora, Ind.
Baush Mch. Tool Co., Springfield, Mass.
Bickford Drill & Tool Co., Cincinnati, O.
Bement, Miles & Co., New York.
Dallett & Co., Thos. H., Phila., Pa.
Niles Tool Works Co., New York.
Pond Mach. Tool Co., New York.

Drilling Machines, Multiple Spindle
Baker Bros., Toledo, O.
Barnes Co., B. F., Rockford, Ill.
Barnes Co., W. F. & John, Rockford, Ill.
Baush Mch. Tool Co., Springfield, Mass.
Bement, Miles & Co., New York.
Bickford Drill & Tool Co., Cincinnati, Ohio.
Dallett & Co., Thos. H., Phila., Pa.
Garvin Mach. Co., New York.
Harrington Son & Co., Edwin, Philadelphia, Pa.
Newton Machine Tool Works, Philadelphia, Pa.
Niles Tool Works Co., New York.

Drilling Machines, Portable
Dallett & Co., Thos. H., Phila., Pa.

Drilling Machines, Pneumatic
Chicago Pneumatic Tool Co., Chicago, Ill.
Cleveland Pneu. Tool Co., Cleveland, Ohio.
Phila. Pneumatic Tool Co., Philadelphia, Pa.

Drilling Machines, Radial
Amer. Tool Wks. Co., Cincin., O.
Baush Mch. Tool Co., Springfield, Mass.
Bement, Miles & Co., New York.
Bickford Drill & Tool Co., Cincinnati, Ohio.
Cleveland Punch & Shear Works Co., Cleveland, O.
Dreses Mach. Tool Co., Cincin., O.
Fosdick & Holloway M. T. Co., Cincinnati, O.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Hill, Clarke & Co., Boston, Mass.
Niles Tool Works Co., New York.
Pond Mach. Tool Co., New York.
Reade Mchry Co., Cleveland, O.

Drilling Machines, Turret
Niles Tool Works Co., New York.
Quint, A. D., Hartford, Conn.

Drilling Machines, Upright
Am. Tool Wks. Co., Cincinnati, O.
Aurora Tool Works, Aurora, Ind.
Baker Bros., Toledo, O.
Barnes Co., B. F., Rockford, Ill.
Barnes Co., W. F. & John, Rockford, Ill.
Bement, Miles & Co., New York.
Blaisdell & Co., P., Worcester, Mass.
Cincinnati Mach. Tool Co., Cin., O.
Davis Mach. Co., W. P., Rochester, N. Y.
Fosdick & Holloway Mach. Tool Co., Cincinnati, O.
Gould & Eberhardt, Newark, N. J.
Harrington & Son Co., Edwin, Philadelphia, Pa.
Hill, Clarke & Co., Boston, Mass.
Hoefer Mfg. Co., Freeport, Ill.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
Niles Tool Works Co., New York.
New Haven Mfg. Co., New Haven, Conn.
Pratt & Whitney Co., Hartford, Conn.
Sibley & Ware, South Bend, Ind.
Washburn Shops, Worcester, Mass.

Drills, Center
Pratt & Whitney Co., Hartford, Conn.
Slocomb & Co., J. T., Providence, R. I.

Drills, Rail
Bement, Miles & Co., New York.
Niles Tool Works Co., New York.

Drills, Ratchet
Parker Co., Chas., Meriden, Ct.
Pratt & Whitney Co., Hartford, Conn.

Dynamos
Akron Elec. Mfg. Co., Akron, O.
C & C Electric Co., New York.
Commercial Electric Co., Indianapolis, Ind.
Crocker-Wheeler Electric Co., Ampere, N. J.
General Elec. Co., New York.
Jantz & Leist Elec. Co., Cincin., O.
Northern Elec. Mfg. Co., Madison, Wis.
Robbins & Myers Co., Springfield, Ohio.
Sprague Elec. Co., New York.
Triumph Elec. Co., Cincinnati, O.
Westinghouse Electric & Mfg. Co., Pittsburgh, Pa.

Electrical Supplies
Akron Elec. Mfg. Co., Akron, O.
Commercial Electric Co., Indianapolis, Ind.
General Elec. Co., New York.
General Incan. Arc Light Co., New York.
Triumph Electric Co., Cincin., O.
Westinghouse Elec. & Mfg. Co., Pittsburgh, Pa.

Elevators
Albro-Clem Elevator Co., Philadelphia, Pa.
Curtis & Co. Mfg. Co., St. Louis, Mo.
Morse, Williams & Co., Phila., Pa.

Emery Wheels
See Grinding Wheels.

Enclosures, Tool-room
Merritt & Co., Philadelphia, Pa.

Engines, Gas and Gasoline
Backus Water Motor Co., Newark, N. J.
Charter Gas Engine Co., Sterling, Ill.
Columbus Mach. Co., Columbus, O.
Economy Engine Co., St. Joseph, Mich.
Foos Gas Eng. Co., Springfield, O.
Mietz, August, New York.
New Era Iron Wks., Dayton, O.
Olds Motor Wks., Lansing, Mich.
Patterson, Gottfried & Hunter, Ltd., New York.
Regal Gasoline Engine Co., Coldwater, Mich.
Springfield Gas Eng. Co., Springfield, O.
Struthers, Wells & Co., Warren, Pa.
Weber Gas & Gasoline Eng. Co., Kansas City, Mo.

Engines, Steam
Buffalo Forge Co., Buffalo, N. Y.
Frick Co., Waynesboro, Pa.
Rand Drill Co., New York.
Struthers, Wells & Co., Warren, Pa.

Engine Stop
Consolidated Engine Stop Co., New York.

Exhaust Fans
Buffalo Forge Co., Buffalo, N. Y.

Fans, Electric
Northern Elec. Mfg. Co., Madison, Wis.
Sprague Elec. Co., New York.
Westinghouse Elec. & Mfg. Co., Pittsburgh, Pa.

Files and Rasps
Barnett Co., G. & H., Phila., Pa.
Hammacher, Schlemmer & Co., New York.
Nicholson File Co., Prov., R. I.
Troy File Works, Troy, N. Y.

Fillers, Oil Can
The Winkley Co., Hartford, Conn.

Fittings, Steam
Crane Co., Chicago, Ill.
Crosby Steam Gage & Valve Co., Boston, Mass.
Jenkins Bros., New York.
Lunkenheimer Co., Cincinnati, O.
Walworth Mfg. Co., Boston, Mass.

Forges
Buffalo Forge Co., Buffalo, N. Y.
Miner & Peck Mfg. Co., New Haven, Conn.

Forgings, Drop
Billings & Spencer Co., Hartford, Conn.
Miner & Peck Mfg. Co., New Haven, Conn.
Williams & Co., J. H., Brooklyn, N. Y.
Wyman & Gordon, Worcester, Mass.

Forgings, Hydraulic
Wyman & Gordon, Worcester, Mass.

Forgings, Steel
Wyman & Gordon, Worcester, Mass.

Foundry Furnishings
Obermayer Co., S., Cincinnati, O.
Whiting Foundry Equip. Co., Harvey, Ill.

Furnaces, Coal, Gas and Oil
Am. Gas Furnace Co., N. Y. City.
Buffalo Forge Co., Buffalo, N. Y.
Chicago Flexible Shaft Co., Chicago, Ill.

Gages, Recording
Bristol Co., Waterbury, Conn.

Gages, Standard
Brown & Sharpe Mfg. Co., Providence, R. I.
Rogers, John M., Boat, Gage & Drill Works, Gloucester City, N. J.
Sawyer Tool Mfg. Co., Fitchburg, Mass.
Slocomb & Co., J. T., Prov., R. I.
Starrett Co., L. S., Athol, Mass.

Gear Cutting Machinery
Bickford Drill & Tool Co., Cin., O.
Brown & Sharpe Mfg. Co., Providence, R. I.
Clough, R. M., Tolland, Conn.
Fellows Gear Shaper Co., Springfield, Vt.
Gleason Tool Co., Rochester, N. Y.
Gould & Eberhardt, Newark, N. J.
Harrington & Son Co., Edwin, Philadelphia, Pa.
Newton Mch. Tool Wks., Phil., Pa.
Niles Tool Works Co., New York.
Whiton Machine Co., D. E., New London, Conn.

Gages, Steam
Crosby Steam Gage & Valve Co., Boston, Mass.

Gas Producers
Am. Gas Furnace Co., N. Y. City.

Gears, Cut
Bilgram, Hugo, Philadelphia, Pa.
Boston Gear Wks., Boston, Mass.
Cleveland Gear Wks., Cleveland, O.
Fawcus Mach. Co., Pittsburgh, Pa.
Fellows Gear Shaper Co., Springfield, Vt.
Gleason Tool Co., Rochester, N. Y.
Gould & Eberhardt, Newark, N. J.
Grant Gear Works, Boston, Mass.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Horsburgh & Scott, Cleveland, O.
New Process Raw Hide Co., Syracuse, N. Y.
Nuttall Co., R. D., Pittsburgh, Pa.
N. Y. Gear Wks., Brooklyn, N. Y.
Philadelphia Gear Works, Philadelphia, Pa.
Simonds Mfg. Co., Pittsburgh, Pa.
Van Dorn & Dutton Co., Cleveland, O.

Gears, Molded
Franklin Mfg. Co., Syracuse, N. Y.
Greenwald Co., I. & E., Cincin., O.
Poole & Son Co., Robt., Baltimore, Md.

Gears, Rawhide
Chicago Raw Hide Co., Chicago, Ill.
Fawcus Mch. Co., Pittsburgh, Pa.
New Process Raw Hide Co., Syracuse, N. Y.
Nuttall Co., R. D., Pittsburgh, Pa.

Gears, Worm
Albro-Clem Elevator Co., Philadelphia, Pa.
Fawcus Mach. Co., Pittsburgh, Pa.
Morse, Williams & Co., Phila., Pa.
Nuttall Co., R. D., Pittsburgh, Pa.
Simonds Mfg. Co., Pittsburgh, Pa.
Van Dorn & Dutton Co., Cleveland, O.

Graphite
Dixon Crucible Co., Jos., Jersey City, N. J.
Obermayer Co., S., Cincinnati, O.

Grinders, Center
Heald & Son, L. S., Barre, Mass.
Leland & Faulconer Mfg. Co., Detroit, Mich.

Grinders, Cock
Windsor Mach. Co., Windsor, Vt.

Grinders, Cutter
Adams Co., Dubuque, Iowa.
Automatic Mach. Co., Greenfield, Mass.
Cincinnati Milling Mach. Co., Cincinnati, O.
Garvin Mach. Co., New York.
Gould & Eberhardt, Newark, N. J.
Modern Tool Co., Erie, Pa.
Norton Emery Wheel Co., Worcester, Mass.
Oesterlein Mach. Co., Cincin., O.
Pratt & Whitney Co., Hartford, Conn.
Rivett- Dock Co., Boston, Mass.

Grinders, Disc
Besly & Co., Chas. H., Chicago, Ill.
Gorton Mach. Co., Geo., Racine, Wis.
Iroquois Mach. Co., Provi., R. I.

Grinders, Drill
Gorton Mach. Co., Geo., Racine, Wis.
Heald & Son, L. S., Barre, Mass.
Standard Tool Co., Cleveland, O.
Washburn Shops, Worcester, Mass.
Wilmarth & Morman Co., Grand Rapids, Mich.

Grinders, Tool
Barnes Co., B. F., Rockford, Ill.
Barnes Co., W. F. & John, Rockford, Ill.
Diamond Mach. Co., Prov., R. I.
Gisholt Mach. Co., Madison, Wis.
Iroquois Mach. Co., Provi., R. I.
Landis Tool Co., Waynesboro, Pa.
Leland & Faulconer Mfg. Co., Detroit, Mich.
Northampton Emery Wheel Co., Leeds, Mass.
Oesterlein Mach. Co., Cincin., O.
Safety Emery Wheel Co., Springfield, O.
Whitney Mfg. Co., Hartford, Ct.

Grinding Machines
Besly & Co., Chas. H., Chicago, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Builders' Iron Foundry, Providence, R. I.
Diamond Mach. Co., Prov. ,R. I.
Goodell-Pratt Co., Greenfield, Mass.
Gorton Mach. Co., Geo., Racine, Wis.
Hill, Clarke & Co., Boston, Mass.
Iroquois Mach. Co., Provi., R. I.
Landis Tool Co., Waynesboro, Pa.
Northampton Emery Wheel Co., Leeds, Mass.
Northern Elec. Mfg. Co., Madison, Wis.
Norton Emery Wheel Co., Worcester, Mass.
Safety Emery Wheel Co., Springfield, Mass.
Washburn Shops, Worcester, Mass.
Webster & Perks Tool Co., Springfield, O.
Wilmarth & Morman Co., Grand Rapids, Mich.

Grinding Wheels
Abrasive Material Co., Phila., Pa.
Builders' Iron Foundry, Providence, R. I.
Carborundum Co., Niagara Falls, N. Y.
Diamond Mach. Co., Provi., R. I.
Hampden Cor. Wheel Co., Brightwood, Mass.
Northampton Emery Wheel Co., Leeds, Mass.
Norton Emery Wheel Co., Worcester, Mass.
Safety Emery Wheel Co., Springfield, O.

Gun Barrel Machinery
Bement, Miles & Co., New York.
Diamond Mach. Co., Provi., R. I.
Niles Tool Works Co., New York.
Pond Mach. Tool Co., New York.
Reed Co., F. E., Worcester, Mass.

Hack Saw Blades and Frames
Goodell-Pratt Co., Greenfield, Mass.
Millers Falls Co., New York.
Starrett Co., L. S., Athol, Mass.
West Haven Mfg. Co., New Haven, Conn.

Hack Saws, Power
Hoefer Mfg. Co., Freeport, Ill.
Millers Falls Co., New York.

Hammers, Drop
Bement, Miles & Co., New York.
Billings & Spencer Co., Hartford, Conn.
Bliss Co., E. W., Brooklyn, N. Y.
Miner & Peck Mfg. Co., New Haven, Conn.

Hammers, Pneumatic
Chicago Pneumatic Tool Co., Chicago, Ill.
Cleveland Pneumatic Tool Co., Cleveland, O.
Dallett & Co., Thos. H., Phila., Pa.
Phila. Pneu. Tool Co., Philadelphia, Pa.

Hammers, Steam
Bement, Miles & Co., New York.
Bethlehem Fdry. & Mach. Co., So. Bethlehem, Pa.
Chambersburg Engineering Co., Chambersburg, Pa.
Cleveland Punch & Shear Wks. Co., Cleveland, O.

Handles, Machine Tool
Schacht Mfg. Co., Cincinnati, O.

Heating Machines, Automatic
Am. Gas Furnace Co., New York.

Heating and Ventilating Apparatus
Buffalo Forge Co., Buffalo, N. Y.

Hoists, Electric
C & C Electric Co., New York.
Hunt Co., C. W., West New Brighton, N. Y.
Northern Engineering Works, Detroit, Mich.
Pawling & Harnischfeger, Milwaukee, Wis.

Hoists, Hand
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Moyer & Co., J. W., Philadel., Pa.
Yale & Towne Mfg. Co., New York.

Hoists, Pneumatic
Chicago Pneumatic Tool Co., Chicago, Ill.
Cleveland Pneumatic Tool Co., Cleveland, O.
Curtis & Co. Mfg. Co., St. Louis, Mo.
Northern Engineering Wks., Detroit, Mich.
Rand Drill Co., New York.

Hoisting and Conveying Machinery
Brown Hoisting Mchry. Co., New York.
Caldwell & Son Co., H. W., Chicago, Ill.
Eastern Mchry. Co., New Haven, Conn.
Hunt Co., C. W., West New Brighton, N. Y.
Link Belt Engineering Co., Philadelphia, Pa.
Moyer & Co., J. W., Philadel., Pa.
Niles-Bement-Pond Co., New York.

Indicators, Speed
Starrett Co., L. S., Athol, Mass.

Indicators, Steam
Crosby Steam Gage & Valve Co., Boston, Mass.

Inspection and Tests
Hunt Co., Robt. W., Chicago, Ill.

Injectors
Lunkenheimer Co., Cincinnati, O.
Sellers & Co., Wm., Phila., Pa.

Instruction Schools
See Schools, Correspondence.

Jacks, Hydraulic
Bethlehem Fdry. & Mch. Co., So. Bethlehem, Pa.
Watson-Stillman Co., New York.

Keys, Machine
Whitney Mfg. Co., Hartford, Ct.

Key Seaters
Baker Bros., Toledo, O.
Bement, Miles & Co., New York.
Chattanooga Mchy. Co., Chattanooga, Tenn.
Davis Mach. Co., W. P., Rochester, N. Y.
Mitts & Merrill, Saginaw, Mich.

Lamps, Arc
General Electric Co., N. Y. City.
Gen. Incan. Arc Light Co., N. Y. City.
Westinghouse Elec. & Mfg. Co., Pittsburgh, Pa.

Lathe Dogs
Armstrong Bros. Tool Co., Chicago, Ill.
Besly & Co., Chas. H., Chicago, Ill.
Le Count, Wm. G., So. Norwalk, Conn.
Pratt & Whitney Co., Hartford, Conn.

Lathes
American Tool Works. Co., Cin., O.
Automatic Mach. Co., Greenfield, Mass.
Auto. Mach. Co., Bridgeport, Ct.
Barker & Chard Mach. T. Co., Cincinnati, O.
Barnes Co., B. F., Rockford, Ill.
Barnes Co., W. F., & John, Rockford, Ill.
Bement, Miles & Co., New York.
Blaisdell & Co., P., Worcester, Mass.
Bradford Mach. Tool Co., Cin., O.
Bullard Mach. Tool Co., Bridgeport, Conn.
Davis Mach. Co., W. P., Rochester, N. Y.
Diamond Machine Co., Provi., R. I.
Fairbanks Mach. Tool Co., Springfield, O.
Fay & Scott, Dexter, Me.
Flather & Co., Nashua, N. H.
Garvin Mach. Co., New York.
Grant Tool Co., Franklin, Pa.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Hendey Mach. Co., Torrington, Ct.
Hill, Clarke & Co., Boston, Mass.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
McCabe, J. J., New York.
New Haven Mfg. Co., New Haven, Conn.
Niles Tool Works Co., New York.
Pond Mach. Tool Co., New York.
Pratt & Whitney Co., Hartford, Conn.
Reed Co., F. E., Worcester, Mass.
Schumacher & Boye, Cincinnati, O.
Sebastian Lathe Co., Cincin., O.
Seneca Falls Mfg. Co., Seneca Falls, N. Y.
Washburn Shops, Worcester, Mass.

Lathes, Automatic Screw-Threading
Automatic Machine Co., Bridgeport, Conn.

Lathes, Bench
Faneuil Watch Tool Co., Boston, Mass.
Waltham Watch Tool Co., Springfield, Mass.

Letters, Pattern
Butler, A. G., N. Y. City.

Levels
Starrett Co., L. S., Athol, Mass.

Lockers, Clothes
Merritt & Co., Philadelphia, Pa.

Locomotives, Shop
Hunt Co., C. W., West New Brighton, N. Y.

Lubricants
Besly & Co., Chas. H., Chicago, Ill.
Dixon Crucible Co., Jos., Jersey City, N. J.

Lubricators
Besly & Co., Chas. H., Chicago, Ill.
Bowen Mfg. Co., Auburn, N. Y.
Crane Co., Chicago, Ill.
Lunkenheimer Co., Cincinnati, O.

Machinery Builders, Special
American Fdry. & Mach. Co., Hanover, Pa.
Blanchard Mach. Co., The, Boston, Mass.
Pratt & Whitney Co., Hartford, Conn.
Simonds Mfg. Co., Pittsburgh, Pa.
Stowell, J. A., Leominster, Mass.

Machine Screws
Worcester Mach. Screw Co., Worcester, Mass.

Machinists' Small Tools
Besly & Co., Chas. H., Chicago, Ill.
Billings & Spencer Co., Hartford, Conn.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Twist Drill Co., Cleveland, O.
Hammacher, Schlemmer & Co., New York.
Patterson, Gottfried & Hunter, Ltd., New York.
Sawyer Tool Mfg. Co., Fitchburg, Mass.
Slocomb & Co., J. T., Provi., R. I.
Starrett Co., L. S., Athol, Mass.

Mandrels, Expanding
Nicholson & Son, W. H., Wilkesbarre, Pa.

Mandrels, Solid
Cleveland Twist Drill Co., Cleveland, O.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Rogers, John M., Boat, Gage & Drill Works, Gloucester City, N. J.
Standard Tool Co., Cleveland, O.

Measuring Machines
Rogers, John M., Boat, Gage & Drill Works, Gloucester City, N. J.

Micrometer Calipers
Brown & Sharpe Mfg. Co., Providence, R. I.
Sawyer Tool Mfg. Co., Fitchburg, Mass.
Slocomb & Co., J. T., Providence, R. I.
Starrett Co., L. S., Athol, Mass.

Milling Attachments
The Adams Co., Dubuque, Iowa.
Cincinnati Milling Mach. Co., Cincinnati, O.
Kempsmith Mfg. Co., Milwaukee, Wis.
Oesterlein Mach. Co., Cincin., O.

Milling Machines, Bench
Faneuil Watch Tool Co., Boston, Mass.
Waltham Watch Tool Co., Springfield, Mass.

Milling Machines, Portable
Underwood & Co., H. B., Philadelphia, Pa.

Milling Machines, Horizontal
Adams Co., Dubuque, Iowa.
Beaman & Smith Co., Provi., R. I.
Bement, Miles & Co., New York.
Franklin Mach. Wks., Phila., Pa.
Grant Tool Wks., Franklin, Pa.
Hendey Mach. Co., Torrington, Ct.
Ingersoll Mill. Mach. Co., Rockford, Ill.
Newton Mach. Tool Wks., Philadelphia, Pa.
Niles Tool Works Co., New York.
Pratt & Whitney Co., Hartford, Conn.

Milling Machines, Plain
American Tool Wks. Co., Cin., O.
Aurora Tool Works, Aurora, Ind.
Bement, Miles & Co., New York.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mach. Co., Cincinnati, O.
Garvin Mach. Co., New York.
Hendey Mach. Co., Torrington, Ct.
Hill, Clarke & Co., Boston, Mass.
Kempsmith Mfg. Co., Milwaukee, Wis.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
Oesterlein Mach. Co., Cincin., O.
Whitney Mfg. Co., Hartford, Ct.

Milling Machines, Universal
American Tool Wks. Co., Cin., O.
Aurora Tool Works, Aurora, Ind.
Bement, Miles & Co., New York.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mach. Co., Cincinnati, O.
Garvin Mach. Co., New York.
Hendey Mach. Co., Torrington, Ct.
Hill, Clarke & Co., Boston, Mass.
Kempsmith Mfg. Co., Milwaukee, Wis.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
Niles Tool Works Co., New York.
Oesterlein Mach. Co., Cincin., O.
Waltham Watch Tool Co., Springfield, Mass.

Milling Machines, Vertical
Bement, Miles & Co., New York.
Brown & Sharpe Mfg. Co., Providence, R. I.
Garvin Mach. Co., New York.
Ingersoll Mill. Mach. Co., Rockford, Ill.
Newton Mach. Tool Wks., Philadelphia, Pa.
Niles Tool Works Co., New York.
Pratt & Whitney Co., Hartford, Conn.

Milling Tools, Adjustable
Geometric Drill Co., Westville, Ct.
Rogers, Boat, Gage & Drill Wks., John M., Gloucester City, N. J.

Molding Machines
The Adams Co., Dubuque, Iowa.
Tabor Mfg. Co., Philadelphia, Pa.
Webster & Perks Tool Co., Springfield, O.

Motors, Electric
Akron Elec. Mfg. Co., Akron, O.
C & C Electric Co., New York.
Commercial Electric Co., Indianapolis, Ind.
Crocker-Wheeler Co., Ampere, N. J.
Eck Dynamo & Motor Works, Belleville, N. J.
General Electric Co., New York.
General Incand. Arc Light Co., New York.
Jantz & Leist Elec. Co., Cin., O.
Northern Elec. Mfg. Co., Madison, Wis.
Robbins & Myers Co., Springfield, Ohio.
Sprague Electric Co., New York.
Triumph Elec. Co., Cincinnati, O.
Westinghouse Elec. & Mfg. Co., Pittsburgh, Pa.

Name Plates
Franklin Mfg. Co., Syracuse, N. Y.

Nut Tappers
See Bolt and Nut Machinery.

Oil Cups and Covers
Bay State Stamping Co., Worcester, Mass.
Besly & Co., Chas. H., Chicago, Ill.
Bowen Mfg. Co., Auburn, N. Y.
Crane Co., Chicago, Ill.
Lunkenheimer Co., Cincinnati, O.
The Winkley Co., Hartford, Conn.

Oils
Besly & Co., Chas. H., Chicago, Ill.
Houghton & Co., E. F., Philadelphia, Pa.

Packing, Metallic
U. S. Metallic Packing Co., Philadelphia, Pa.

Packing, Steam Joint
Jenkins Bros., New York.

Patents
Baldwin, Davidson & Wight, Washington, D. C.
Cromwell, W. H., Washington, D. C.
Cullen, Orlan Clyde, Washington, D. C.

Pattern Shop Machinery
American Machinery Co., Grand Rapids, Mich.
Baker Bros., Toledo, O.
Fay & Scott, Dexter, Me.
Machinery Exchange, Chicago, Ill.

Patterns, Wood
Balkwill Pattern Works, Cleveland, Ohio.
Gobeille Pattern Co., Cleveland, O.
Lorentz & Evarts, Hartford, Conn.
Topping, J. R., Hartford, Conn.

Phosphor Bronze
Phosphor Bronze Smelting Co., Philadelphia, Pa.

Pipe and Fittings
Crane Co., Chicago, Ill.

Pipe Cutting and Threading Machines
Curtis & Curtis Co., Bridgeport, Conn.
Merrell Mfg. Co., Toledo, O.
Saunders' Sons, D., Yonkers, N. Y.
Wells Bros. Co., Greenfield, Mass.

Pipe Fitters' Tools
Cleveland Twist Drill Co., Cleveland, O.
Saunders' Sons, D., Yonkers, N. Y.
Standard Tool Co., Cleveland, O.

Planer, Jack
Armstrong Bros. Tool Co., Chicago, Ill.

Planers
Amer. Tool Wks. Co., Cincin., O.
Bartlett, E. E., Boston, Mass.
Belmer Mach. Tool Co., Cin., O.
Bement, Miles & Co., New York.
Betts Mach. Co., Wilmington, Del.
Cincinnati Planer Co., Cincin., O.
Detrick & Harvey Mch. Co., Baltimore, Md.
Flather Planer Co., Mark, Nashua, N. H.
Garvin Mach. Co., New York.
Gray Co., G. A., Cincinnati, O.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Hendey Mach. Co., Torrington, Ct.
Hill, Clarke & Co., Boston, Mass.
Niles Tool Works Co., New York.
New Haven Mfg. Co., New Haven, Conn.

Planers—*Continued*
Pond Mach. Tool Co., New York.
Sellers & Co., Wm., Phila., Pa.
Whitcomb Mfg. Co., Worcester, Mass.
Woodward & Powell Planer Co., Worcester, Mass.

Planers, Portable
Underwood & Co., H. B., Philadelphia, Pa.

Planers, Rotary
Bement, Miles & Co., New York.
Cleveland Punch & Shear Works, Cleveland, O.
Franklin Mach. Wks., Phila., Pa.
Newton Mch. Tool Works, Philadelphia, Pa.
Pond Mach. Tool Co., New York.
Underwood & Co., H. B., Phila., Pa.

Presses, Hand
Elmes Engineering Works, Chas. F., Chicago, Ill.

Presses, Hydraulic
Bement, Miles & Co., New York.
Elmes Engineering Works, Chas. F., Chicago, Ill.
Watson-Stillman Co., New York.

Presses, Power
Automatic Mach. Co., Bridgeport, Conn.
Bethlehem Fdry. & Mch. Co., So. Bethlehem, Pa.
Bliss Co., E. W., Brooklyn, N. Y.
Dill Mach. Works, T. C., Philadelphia, Pa.
Mossberg & Granville Mfg. Co., Providence, R. I.

Profilers
Garvin Mach. Co., New York.
Pratt & Whitney Co., Hartford, Conn.

Pulley Turning and Boring Machines
Harrington, Son & Co., Edwin, Philadelphia, Pa.
New Haven Mfg. Co., New Haven, Conn.
Niles Tool Works Co., New York.

Pulleys
Cresson Co., Geo. V., Philadel., Pa.
Jones Fdry. & Mch. Co., W. A., Chicago, Ill.
Poole & Son Co., Robt., Baltimore, Md.
Reeves Pulley Co., Columbus, Ind.

Pulleys, Friction Cone
Evans Friction Cone Co., Boston, Mass.

Pumps, Hydraulic
Elmes Engineering Works, Chas. F., Chicago, Ill.
Watson-Stillman Co., New York.

Punches, Hydraulic
Bement, Miles & Co., New York.
Bethlehem Fdry. & Mch. Co., So. Bethlehem, Pa.
Watson-Stillman Co., New York.

Punches, Power
Bliss Co., E. W., Brooklyn, N. Y.
Bremer Mach. & Tool Co., Kalamazoo, Mich.
Buffalo Forge Co., Buffalo, N. Y.
Cleveland Punch & Shear Wks., Cleveland, O.
Hilles & Jones Co., Wilmington, Del.
Long & Allstatter Co., Hamilton, Ohio.
Reade Mchry Co., Cleveland, O.

Rack Cutting Machines
Fellows Gear Shaper Co., Springfield, Vt.
Gould & Eberhardt, Newark, N. J.
Le Belond Mach. Tool Co., R. K., Cincinnati, O.
Reed Co., F. E., Worcester, Mass.

Racks, Cut
Fellows Gear Shaper Co., Springfield, Vt.
Nuttall Co., R. D., Pittsburgh, Pa.
Simonds Mfg. Co., Pittsburgh, Pa.
Van Dorn & Dutton Co., Cleve., O.

Reamers
Cleveland Twist Drill Co., Cleveland, O.
Clough, R. M., Tolland, Conn.
McCrosky & Huber, Cincinnati, O.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt & Whitney Co., Hartford, Conn.
Rogers, John M., Boat, Gage & Drill Works, Gloucester City, N. J.
Standard Tool Co., Cleveland, O.
Wells Bros. Co., Greenfield, Mass.

Reaming Stands
Flather Planer Co., Mark, Nashua, N. H.

Rheostats
General Incan. Arc Light Co., New York.

Riveters, Hydraulic
Bement, Miles & Co., New York.
Watson-Stillman Co., New York.

Riveters, Pneumatic
Bement, Miles & Co., New York.
Cleveland Pneumatic Tool Co., Cleveland, O.
Philadelphia Pneumatic Tool Co., Philadelphia, Pa.

Riveting Machines
Bement, Miles & Co., New York.
Bethlehem Foundry & Mach. Co., So. Bethlehem, Pa.
Chambersburg Engineering Co., Chambersburg, Pa.
Long & Allstatter Co., Hamilton, Ohio.

Roller and Ball Bearings
Ball Bearing Co., Philadel., Pa.
Mossberg & Granville Mfg. Co., Providence, R. I.
Roller Bearing & Equipment Co., Keene, N. H.

Rolling Mill Machinery
Cleveland Punch & Shear Wks. Co., Cleveland, O.
Diamond Drill & Mch. Co., Birdsboro, Pa.
Dill Mach. Works, T. C., Philadelphia, Pa.
Hilles & Jones Co., Wilmington, Del.
Mossberg & Granville Mfg. Co., Providence, R. I.
Pratt & Whitney Co., Hartford, Conn.

Safety Valves Pop
Crane Co., Chicago, Ill.
Crosby Steam Gage & Valve Co., Boston, Mass.
Lunkenheimer Co., Cincinnati, O.

Sawing Machines, Metal
Cleveland Punch & Shear Works Co., Cleveland, O.
Newton Mach. Tool Works, Philadelphia, Pa.
Pratt & Whitney Co., Hartford, Conn.
Reade Mchry. Co., Cleveland, O.

Schools, Correspondence
Amer. School of Correspondence, Boston, Mass.
Consolidated Schools, N. Y. City.
International Correspond. Schools, Scranton, Pa.

Schools, Technical
Mich. College of Mines, Houghton, Mich.

Screw Machines, Automatic
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Machine Screw Co., Cleveland, Ohio.
Dreses Mach. Tool Co., Cincin., O.
Windsor Mach. Co., Windsor, Vt.

Screw Machines, Hand
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Mch. Screw Co., Cleveland, O.
Garvin Mach. Co., New York.
Jones & Lamson Mch. Co., Springfield, Vt.
Pearson Mach. Co., Chicago, Ill.
Potter & Johnston Mach. Co., Pawtucket, R. I.
Pratt & Whitney Co., Hartford, Conn.
Warner & Swasey Co., Cleveland, Ohio.
Windsor Mach. Co., Windsor, Vt.

Screw Machinery, Wood and Lag
Baker Bros., Toledo, Ohio.
Cook Co., Asa S., Hartford, Conn.

Screw Plates
Besly & Co., Chas. H., Chicago, Ill.
Carpenter Tap & Die Co., J. M., Pawtucket, R. I.
Card Mfg. Co., S. W., Mansfield, Mass.
Hart Mfg. Co., Cleveland, O.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Wells Bros. Co., Greenfield, Mass.
Wiley & Russell Mfg. Co., Greenfield, Mass.

Separators, Magnetic
Sawyer, Ezra, Worcester, Mass.

Second Hand Machinery
Baird Machy. Co., U., Pittsburgh, Pa.
Bowler & Co., Geo. H., Cleveland, Ohio.
Carlin Mchry. & Supply Co., Allegeny, Pa.
Chicago House Wrecking Co., Chicago, Ill.
Dawson, John H., Chicago, Ill.
Fairbanks Co., Philadelphia, Pa.
Garvin Mch. Co., New York.
Hall's Sons, Sam'l, New York.
Hill, Clarke & Co., Boston, Mass.
Marshall & Huschart Mchry. Co., Chicago, Ill.
McCabe, J. J., New York.
Niles Tool Works Co., New York.
Osborn Mchry. Co., New Haven, Conn.
Pratt & Whitney Co., Hartford, Conn.
Prentiss Tool & Supply Co., New York.
Toomey, Frank, Philadelphia, Pa.
Wormer Machy. Co., C. C., Detroit, Mich.

Shafts, Flexible
Chicago Flexible Shaft Co., Chicago, Ill.

Shapers
Amer. Tool Wks. Co., Cincin., O.
Bement, Miles & Co., New York.
Cincinnati Shaper Co., Cincin., O.
Flather Planer Co., Mark, Nashua, N. H.
Garvin Mach. Co., New York.
Hendey Mach. Co., Torrington, Ct.
Gould & Eberhardt, Newark, N. J.
Hill, Clarke & Co., Boston, Mass.
Kelly Co., R. A., Xenia, Ohio.
New Haven Mfg. Co., New Haven, Conn.
Niles Tool Works Co., New York.
Potter & Johnston Mach. Co., Pawtucket, R. I.
Smith & Mills, Cincinnati, O.
Steptoe & Co., John, Cincinnati, O.

Shears, Power
Bethlehem Fdry. & Mch. Co., So. Bethlehem, Pa.
Bliss Co., E. W., Brooklyn, N. Y.
Bremer Mach. & Tool Co., Kalamazoo, Mich.
Buffalo Forge Co., Buffalo, N. Y.
Cleveland Punch & Shear Works, Cleveland, O.
Hilles & Jones Co., Wilmington, Del.
Long & Allstatter Co., Hamilton, Ohio.
Reade Mchry. Co., Cleveland, O.

Shears, Rotary
Bethlehem Foundry & Mach. Co., So. Bethlehem, Pa.
Detrick & Harvey Mach. Co., Baltimore, Md.

Slide Rests
Bartlett Co., E. E., Boston, Mass.
Reed Co., F. E., Worcester, Mass.

Slotters
Baker Bros., Toledo, Ohio.
Bement, Miles & Co., New York
Betts Mach. Wks., Phila., Pa.
Dill Mach. Wks., T. C., Phila., Pa.
Franklin Mach. Wks., Phila., Pa.
Garvin Mach. Co., New York.
New Haven Mfg. Co., New Haven, Conn.
Newton Mach. Tool Wks., Philadelphia, Pa.
Niles Tool Works Co., New York.

Speed Limit System
Consolidated Engine Stop Co., New York.

Springs
Cleveland Wire Spring Co., Cleveland, O.

Sprocket Chains
See Driving Chains.

Stamps, Letters and Figures
Schwerdtle Stamp Co., Bridgeport, Conn.

Stampings, Sheet Steel
Automobile & Cycle Parts Co., Cleveland, O.

Steel, Machinery
International Steel & Mchry. Co., New York.
Patriarche & Bell, New York.
Ward & Son, Edgar T., Boston, Mass.

Steel, Sheet
Automobile & Cycle Parts Co., Cleveland, O.
Ward & Son, Edgar T., Boston, Mass.

Steel, Tool
International Steel & Mach. Co., New York.
Patriarche & Bell, New York.

Straightener, Hydraulic
Bement, Miles & Co., New York.
Watson-Stillman Co., New York.

Swaging Machines
Excelsior Needle Co., Torrington, Conn.

Switchboards
C & C Electric Co., New York.
Triumph Elec. Co., Cincinnati, O.

Taps, Collapsing
Geometric Drill Co., Westville, Ct.

Tapping Machines and Attachments
Baker Bros., Toledo, O.
The Beaman & Smith Co., Providence, R. I.
Bickford Drill & Tool Co., Cin., O.
Cincinnati Mach. Tool Co., Cincinnati, O.
Errington, F. A., N. Y. City.
Fosdick & Holloway Mach. Tool Co., Cincinnati, O.
Garvin Mach. Co., New York.
Geometric Drill Co., New York.
Geometric Drill Co., Westville, Ct.
Gould & Eberhardt, Newark, N. J.
Pratt & Whitney Co., Hartford, Conn.
Seneca Falls Mfg. Co., Seneca Falls, N. Y.
Webster & Perks Tool Co., Springfield, O.

Taps and Dies
Besly & Co., Chas. H., Chicago, Ill.
Card Mfg. Co., S. W., Mansfield, Mass.
Carpenter Tap & Die Co., J. M., Pawtucket, R. I.
Cleveland Twist Drill Co., Cleveland, O.
Crane Co., Chicago, Ill.
Hammacher, Schlemmer & Co., New York.
Hart Mfg. Co., Cleveland, O.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt & Whitney Co., Hartford, Conn.
Standard Tool Co., Cleveland, O.
Wells Bros. Co., Greenfield, Mass.
Wiley & Russell Mfg. Co., Greenfield, Mass.

Telephone System
Clarke Auto. Telephone Switch Board Co., Providence, R. I.

Threading Dies, Opening
Errington, F. A., New York.
Geometric Drill Co., Westville, Ct.
Jones & Lamson Mch. Co., Springfield, Vt.
Modern Tool Co., Erie, Pa.
Pratt & Whitney Co., Hartford, Conn.

Thread Cutting Tools
Besly & Co., Chas. H., Chicago, Ill.
Hart Mfg. Co., The, Cleveland, O.
Pratt & Whitney Co., Hartford, Conn.
Rivett-Dock Co., Boston, Mass.

Tool Holders
Armstrong Bros. Tool Co., Chicago, Ill.
McCrosky & Huber, Cincinnati, O.

Tools
See Machinists' Small Tools.

Transmission Machinery
Allston Fdry. Co., Boston, Mass.
Caldwell & Son Co., H. W., Chicago, Ill.
Cresson & Co., Geo. V., Phila., Pa.
Jones Fdry. & Mch. Co., W. A., Chicago, Ill.
Link-Belt Engineering Co., Philadelphia, Pa.
Patterson, Gottfried & Hunter, Ltd., New York.
Reeves Pulley Co., Columbus, Ind.

Traps, Steam
Houghton & Co., E. F., Philadelphia, Pa.

Trolleys and Tramways
Brown Hoisting Machy. Co., N. Y. City.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Hunt Co., C. W., West New Brighton, N. Y.
Link Belt Engineering Co., Philadelphia, Pa.
Maris Bros., Philadelphia, Pa.
Moyer & Co., J. W., Philadel., Pa.
Yale & Towne Mfg. Co., New York.

Trimmers, Wood
Amer. Mchry. Co., Grand Rapids, Mich.
Leland & Faulconer Mfg. Co., Detroit, Mich.
Washburn Shops, Worcester, Mass.

Turrets, Carriage
Fay & Scott, Detxer, Me.

Turret Machines
Automatic Mach. Co., Greenfield, Mass.
Barker & Chard M. T. Co., Cin., O.
Bradford Mach. Tool Co., Cincinnati, O.
Brown & Sharpe Mfg. Co., Providence, R. I.
Bullard Mach. Tool Co., Bridgeport, Conn.
Cleveland Mach. Screw Co., Cleveland, O.
Dreses Mach. Tool Co., Cincin., O.
Flather & Co., Nashua, N. H.
Garvin Mach. Co., New York.
Gisholt Mch. Co., Madison, Wis.
Grant Tool Co., Franklin, Pa.
Hill, Clarke & Co., Boston, Mass.
Jones & Lamson Mch. Co., Springfield, Vt.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
Lodge & Shipley Mach. Tool Co., Cincinnati, O.
Niles Tool Works Co., New York.
Pearson Mach. Co., Chicago, Ill.
Potter & Johnston Mach. Co., Pawtucket, R. I.
Warner & Swasey Co., Cleveland, Ohio.
Windsor Mach. Co., Windsor, Vt.

Twist Drills
Cleveland Twist Drill Co., Cleveland, O.
Etna Mfg. Co., New York.
Hammacher, Schlemmer & Co., New York.
Morse Twist Drill & M. Co., New Bedford, Mass.
Standard Tool Co., Cleveland, O.

Unions, Brass
Nolte Brass Co., Springfield, O.

Universal Joints
Baush Machine Tool Co., Springfield, Mass.

Valves
See Steam Fittings.

Vises, Drill
Hollands Mfg. Co., Erie, Pa.

Vises, Metal Workers'
Hammacher Schlemmer & Co., New York.
Parker Co., Chas., Meriden, Conn.
Walworth Mfg. Co., Boston, Mass.

Vises, Pipe
Curtis & Curtis Co., Bridgeport, Conn.
Saunders' Sons, D., Yonkers, N. Y.
Walworth Mfg. Co., Boston, Mass.

Vises, Planer and Shaper
Cincinnati Planer Co., Cincin., O.
Hendey Mach. Co., Torrington, Ct.
Pratt & Whitney Co., Hartford, Conn.

Vises, Wood Workers'
Emmert Mfg. Co., Waynesboro, Pa.
Hammacher, Schlemmer & Co., New York.
Wyman & Gordon, Worcester, Mass.

Welding Machines
Long & Allstatter Co., Hamilton, Ohio.

Wire-Forming Machinery
Automatic Mach. Co., Bridgeport, Conn.
Mossberg & Granville Mfg. Co., Providence, R. I.

Worm Hobbing Machines
Grant Tool Wks., Franklin, Pa.
Pratt & Whitney Co., Hartford, Conn.

Worm Milling Machines
Cleveland Mach. Screw Co., Cleveland, O.
Pratt & Whitney Co., Hartford, Conn.

Wrenches
Coes Wrench Co., Worcester, Mass.

Wrenches, Drop Forged
Billings & Spencer Co., Hartford, Conn.
Williams & Co., J. H., Brooklyn, N. Y.

Installing a Steel Hardening Plant.

BY E. R. MARKHAM.

In many shops the unnecessary expense entailed by improper hardening is an item that if saved would amount to a neat sum each year. A milling cutter that costs $12 or $15 to make may be ruined in a few minutes if the hardener does not understand his business, or if he hasn't suitable facilities. Because an ordinary forge was used with satisfaction in hardening tools when all formed work was planed to shape there is no reason for thinking it will provide a satisfactory means of heating a formed milling cutter that is expected to do the work for one-tenth part of the original cost.

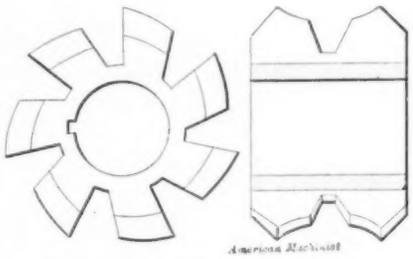
Suppose, for illustration, that a cutter, if properly hardened, will mill 250 pieces of work per day and will mill 1,000 pieces between grindings, and that if not properly hardened the speed of the machine must be reduced to a point where but 175 pieces can be milled per day, and the cutter will do only 600 pieces between grindings. The loss per day on amount of work turned off the machine is then very apparent. The time the machine must be stopped to change the mill and reset the machine, even where another mill is always kept at hand, is quite an item if the cost between changing for every 1,000 and for every 600 is taken into consideration. The extra amount of expense incurred in the grinding room, the shorter life of the cutter and the consequent cost of a new cutter to take the place of the one worn out should also be considered. If there are fifty or more milling machines used in the factory, the amount that might be saved if cutters were properly hardened would pay very satisfactory interest on the investment necessary to install an up-to-date hardening plant.

I am not one who looks on a man as a machine, that sho ld be given no other consideration than how much can be wormed out of him. That is both dead wrong and poor policy. I do think the man who does the hiring of help in a shop should use the same reasoning powers when hiring men to fill important places, that should be used when procuring the equipment, and *vice versa*. Good, hard, common sense is the stuff. A man can be hired to heat tools red hot in a fire, and throw them into a tank of water, who would be glad to get $1 per day, but it probably would be a pretty costly business for the concern he worked for. There is no position in a shop having very much hardening to do, that requires a brainier man than the one in the hardening department, and in no part of the works can a man save or waste the concern more money.

To get the best results from tools they should not be exposed to the action of the air when red hot. The outer surface becomes decarbonized to a considerable degree; consequently it is best to provide a furnace having a muffler to heat the work in, insuring an even heat of any degree wanted. The air is excluded from the work by means of a door; quite a number of pieces may be heated at a time unless the work is large. The heating being continuous there need be no time lost waiting for the fire to come up. The furnaces are not so trying to the eyes as an open fire, and as a consequence the operator can see his heats better and will get them more uniform.

If an extra amount of work is wanted from a tool, if higher speeds would be an object to be desired, if the tendency to crack or spring could be reduced to the minimum, and this all accomplished by a system of hardening so simple that there are few mistakes when used by an intelligent man, having good eyesight, it certainly would pay to install the necessary equipment.

A furnace such as is provided for case-hardening will answer, provided an even heat can be maintained for a sufficient length of time. Then there should be a number of iron pots or boxes of different sizes to hold the work when heating in the oven, a quantity of charred leather, some granulated charcoal, a little fire clay, sev-



A DIFFICULT JOB OF HARDENING.

eral baths for dipping the work—one of water, one of brine and one of raw linseed oil. With the articles named we are equipped to do work that will surprise those not accustomed to this method of hardening.

A formed mill 4 inches in diameter and 3 or 4 inches long should be packed in a mixture of equal quantities of charred leather and of charcoal pounded to a size about one-half as large as a pea, making sure that no part of the mill is within 1½ inches of the box at any point. Keep it in the furnace 3 to 4 hours after the box is heated through; run at a *low* red; remove the box from the furnace at the expiration of the time and plunge the mill into the bath of raw linseed oil, working it around rapidly in the oil in such a manner that the oil will come in contact with the teeth. Keep it in the oil until cold. A formed mill with heavy teeth does not need to have the temper drawn. Mills with teeth cut in the ordinary manner should not be run quite as long, and need drawing for ordinary work to a light straw color, or if drawn in a kettle of oil gaging the heat by a thermometer to 425 or 430 degrees Fahr.

I have hardened thousands of mills and similar cutting tools by this method and have never lost one by cracking. In fact, in eight years' experience with this method I have never had but two pieces crack and these went all to pieces. An examination of the bars they were made from showed they were piped, and piped steel is *bound* to open up when hardened.

I have in mind one particular form of mill (see sketch) that had been hardened by the open-fire-and-water method. It cut ¼ inch deep in a tough grade of machinery steel, the cutter running at a periphery speed of 38 feet per minute, and required grinding every 10 to 12 hours. A similar cutter was made from the same bar of steel and hardened by the method described above. The machine was speeded up until the cutter ran at a periphery speed of 72 feet per minute, and the same relative feed was maintained and the cutter required grinding but once in 138 hours. Cutters hardened by this method showed corresponding results on tool steel or on any of the metals usually cut with milling-machine cutters.

The quality of leather used has a great deal to do with the results obtained. Some of the commercial article is excellent, and some is worse than useless. If you can procure from some shoe factory scrap pieces of sole leather, pack it in one of the hardening boxes, put on the cover and seal tightly with fire clay. When the boxes containing the work to be hardened are removed from the furnace, put this box in and leave it just long enough to char sufficiently to pound up well, and no longer.

To harden by the method described and be able to do the work more cheaply than when done by the open-fire-and-water method, quite a number of pieces may be packed in a box and quite a number of boxes heated at a time provided the furnace is large enough.

I trust that anyone having trouble with their hardening and wishing to test this method will remember that success in hardening depends on *even* heats. Do not use anything as a substitute for leather.

The higher the carbon, as a rule, the less heat is required to harden satisfactorily, and as the theory of this method is the charging of the steel with enough carbon to harden in oil, do not be skeptical as to the use of the oil. The surface of the steel will resist wear much longer than if heated in the open fire and hardened in water. I have hardened mills 14 inches long and of large diameters that gave excellent results—at least, the parties so reported—and gave me afterwards a batch of punch press dies that they didn't care to tackle by the ordinary method.

"Don't you belave thim stories about how quick men are to shoot each other in the Wild West. There is far more men kilt be accident in the sawmills out there than there is in any ither form av sport."—*Mr. Dooley.*

Paper and Iron Friction Gearing.

BY EDWARD C. DE WOLFE.

The employment of friction wheels for the transmission of moderate powers under various suitable conditions is more extensive than is commonly realized. While much used in what may be termed regular or simple work, transmitting continuously greater or less units of power, probably the larger and more important field of special applicability for this form of gearing is in intermittent and reverse-motion driving, such as obtains in hoisting and haulage service, etc., as well as in certain special classes of machinery. Considerable as is the use of paper and iron friction wheel gearing in these lines, the published data relating to its power, design, applications and service peculiarities are comparatively meager, and popular knowledge on the subject is correspondingly deficient.

One of the most tangible and definitely practicable treatments of the subject is that by Prof. Goss, of Purdue University, in a paper presented before the American Society of Mechanical Engineers, and recorded in Vol. XVIII of the "Transactions" of that body. The results of an extended and exhaustive series of tests are therein given, and conclusions are stated which may be briefly summarized as follows:

The most efficient pressure of contact appears to be about 150 pounds per inch of face width of the wheels, the co-efficient of friction under these conditions being about 0.2 for loads such as to cause a slippage of 2 per cent. This should not be taken as meaning that greater power cannot be transmitted by the use of higher contact pressures, but simply that under the conditions stated, the largest percentage of the pressure appears as driving force between the wheels. Higher pressures and small wheels show a lower coefficient of friction and consequently a reduced efficiency. Gradual increase of the load at a given contact pressure of course causes corresponding rise in the percentage of slip, and until the latter passes 3 per cent. the coefficient of friction also increases. For greater slippages the coefficient of friction becomes unreliable and may at any time fall off so as to cause a complete stoppage of the driven wheel. Considering, then, 150 pounds per inch of face as the best pressure and 0.2 as the safe value for the coefficient of friction, the horse-power formula is given as:

$$H = \frac{150 \times 0.2 \times 1\tfrac{1}{2} \pi D \times W \times N}{33{,}000}$$

$$= .000238\, D\, W\, N$$

where D is the diameter and W the face width, both in inches, of the wheel whose speed is N rotations per minute.

The power rating as indicated by this formula is exceeded in practice by sometimes as much as 100 per cent. for certain classes of work under favorable conditions, but for general use the formula as given above rates paper and iron frictions as high as is advisable. The uncertainties regarding uniformity of contact across wide faces, maintenance of clean-working faces, rigidity of supporting shafts and fittings, constancy of contact pressures, etc., are such as to make it unwise to use higher rating in designing this type of gearing. It will often prove necessary, owing to some modifying influence, to materially exceed the 150 pounds per inch contact pressure in order to obtain the desired power through a pair of wheels proportioned by this formula. Likelihood of underestimating working load requirements and possible future increase of power demands, together with the comparatively small capacity of this type of transmission to carry overloads, should not be lost sight of, and certainly constitute a further warrant for setting a conservative

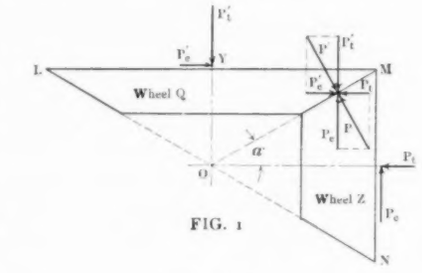


FIG. 1

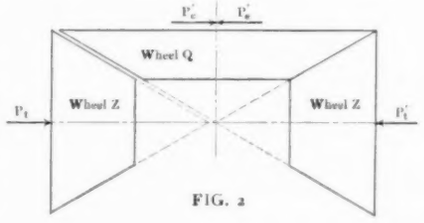


FIG. 2

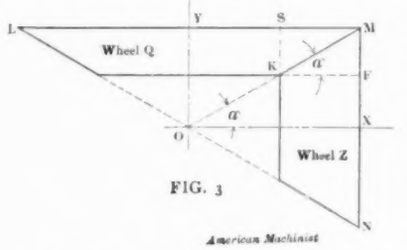


FIG. 3

American Machinist

THE ACTION OF FRICTION WHEEL GEARING.

rating for general use. Faces should be kept as narrow as possible consistently with the conditions limiting the allowable corresponding increase of diameter or speed for a given power.

Miters and bevels, if rigidly supported, show but little inferiority to "spurs," and the differences are not sufficient to require special recognition by way of alteration of the formula, it being understood, however, that mean diameters are to be used in calculation.

The normal contact pressure P, Fig. 1, between the two wheels of a miter or bevel pair, mounted upon shafts at right angles and turning in suitable bearings, must be produced as the resultant of two rectangular components; the one, P_e or P_e^1, a thrust lengthwise of the shaft, forming an endwise pressure on an adjacent bearing the other, P_e or P_e^1, a transverse or radia force on the shaft, constituting an ordinary bearing pressure. In actual practice the working contact may be obtained by mechanically applying either of these forces; the former by some type of thrust bearing, or the latter by an eccentric bearing, or their equivalents. In Fig. 1 either of these may be applied to either wheel but in a reverse-motion drive, as shown in Fig. 2, it is usual to apply a thrust force to the wheels $Z\,Z$ or an eccentric force to the wheel Q.

The magnitude of the operating force necessarily applied to give a desired normal pressure P may be readily determined. In Fig. 1, the speed ratio

$$R = \frac{\text{Diameter of wheel } Q}{\text{Diameter of wheel } Z} = \frac{L\,M}{N\,M} = \frac{Y\,M}{X\,M} = \frac{O\,X}{X\,M} = \cot.\ \alpha.$$

and

$$P : O\,M :: P_e : O\,X :: P_t : X\,M.$$

whence

$$P_e = P\frac{O\,X}{O\,M} = P\cos.\ \alpha \qquad P_t = P\frac{M}{O\,M} = P\sin.\ \alpha$$

From the equality of action and reaction it follows that

$$P_e = P_t^1,$$

and

$$P_t = P_e^1.$$

An expression for determining the amount to deduct from the outer diameter or to add to the inner diameter of a miter or bevel wheel to obtain its mean diameter may also be deduced. Evidently this quantity will be half the difference between the outer and inner diameters, or the whole difference between the corresponding radii. Referring to Fig. 3, $R = \cot.\ \alpha$, as before, and mean diameters are, for wheel Q, $L\,M - S\,M$, and for wheel Z, $N\,M - F\,M$.

$$S\,M = K\,F = K\,M\cos.\ \alpha = W\cos.\ \alpha = W\cos.\ \cot.^{-1} R.$$

which is the desired formula for wheel Q. Similarly, for wheel Z,

$$F\,M = K\,M\sin.\ \alpha = W\sin.\ \alpha = W\sin.\ \cot.^{-1} R.$$

Of a pair of wheels, the paper one should always be the driver, to avoid the uneven wear which would result from the contact of an iron driver rotating against a paper driven in starting the latter from rest under load, or in case of its stoppage by an overload.

The face width of the iron wheel should be made greater than that of the paper; this again to increase the durability of the latter. The face of the paper wheel, however, or the actual face width of driving

contact between the wheels is to be regarded as W in power calculations.

In fixing diameters of wheels, where definite speed ratios are of importance, due allowance should be made for from 2 to 4 per cent. of slippage.

To facilitate computations and to afford

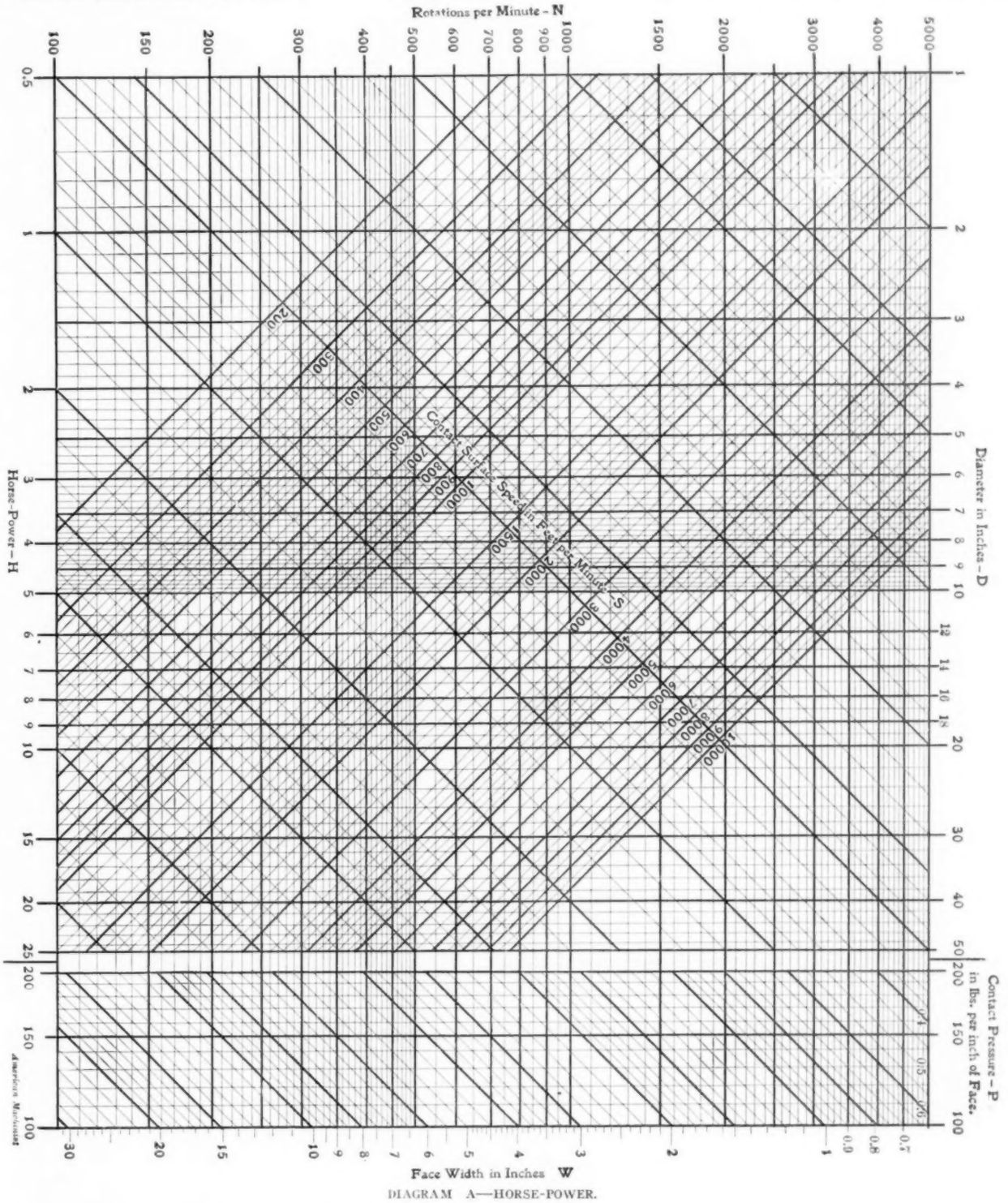

Rotations per Minute - N
Horse-Power - H
Diameter in Inches - D
Contact Pressure - P in lbs. per inch of Face.
Face Width in Inches W
Constant Surface Speed in Feet Per Minute
American Machinist

DIAGRAM A—HORSE-POWER.

relief from numerical calculations, the accompanying diagrams should serve a useful purpose. The foregoing horse-power formula, with slight alterations to suit the purpose, is written as

$$H = .0000061\,P\,W\,S,$$
$$= .0000016\,P\,D\,W\,N,$$

wherein

H = horse-power,

P = pressure of contact in pounds per inch of face width,

W = width of faces in contact in inches,

S = speed of contact surfaces in feet per minute,

D = diameter of wheel in inches (mean diameter for miter or bevel),

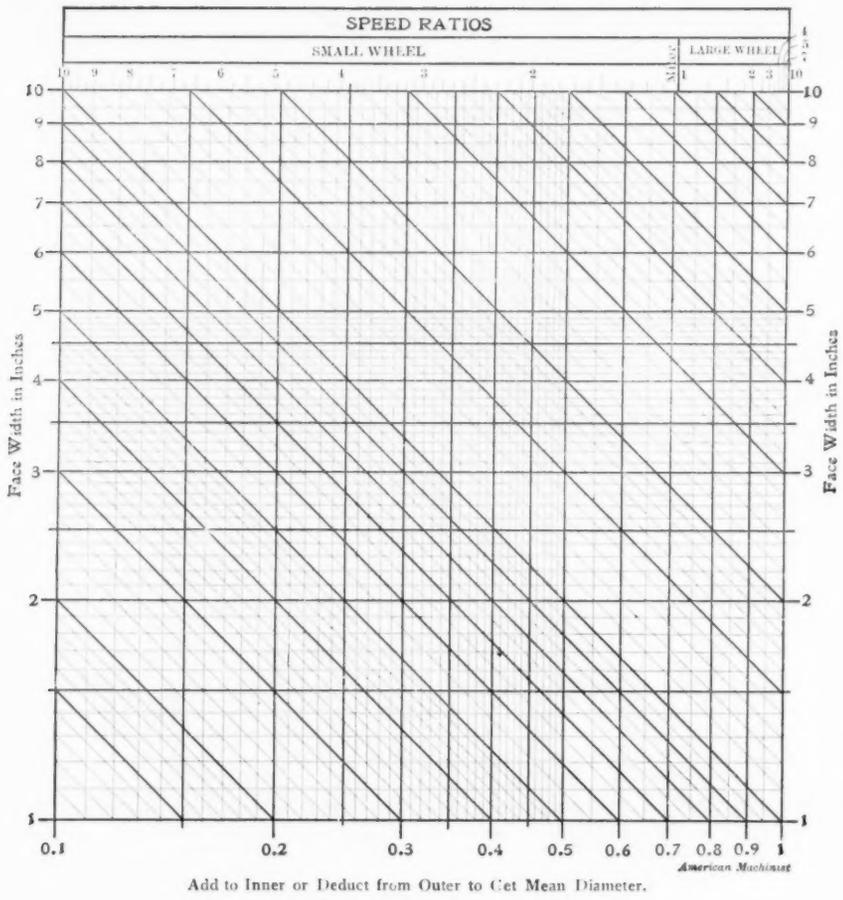
N = number of revolutions per minute.

The coefficient of friction is taken at 0.2 and included in the constant of the formula, but P is given as an individual factor and provision made in the horse-power diagram A for the use of values from 100 to 200 for this quantity, this being as great a range as can be considered reliable and proper for the coefficient of friction used. Auxiliary diagrams B and C are added for the ready determination of mean diameters and required operating forces for miters and bevels, solving the formulas already given.

Following are brief and concise directions for the use of the diagrams:

HORSE-POWER DIAGRAM, A.

1. To Find Surface Speed, S.—Locate intersection of vertical for diameter D



Add to Inner or Deduct from Outer to Get Mean Diameter.

DIAGRAM B—MEAN DIAMETERS.

with horizontal for rotative speed N and read surface speed S on an upward-to-left diagonal through (or near) this intersection.

2. To Find Width of Contact Face, W. —(a) Knowing S, or having found it as in (1), locate intersection of its diagonal with vertical for desired horse-power H; trace thence horizontally to right to vertical for contact pressure P; thence diagonally upward and read required face width W on side scale.

(b) Knowing only the desired horse-power H and a given rotative speed N, locate intersection of vertical for H with horizontal for N; trace then diagonally upward-to-right or downward to left to vertical for an assumed or trial diameter D, thence horizontally to right for face width W as in (a). If result be for any reason unsatisfactory, follow same upward-to-right diagonal, trying other diameters D until limiting conditions are satisfied: or trace backward, as in (3), from a desirable value for face width W to same diagonal, and read corresponding diameter D on vertical through this intersection.

3. To Find Horse-power H or Rotative Speed N for a Given Wheel.—From known face width W trace diagonally downward to vertical for contact pressure P, thence horizontally to left to vertical for known diameter D. On an upward-to-right diagonal through this point will lie all intersections of verticals for horse-power H with horizontals for correspoding values of rotative speed N.

MEAN DIAMETER DIAGRAM, B.

4. To Find Mean Diameter for a Miter or Bevel.—From proper speed ratio R on scales at top of diagram B, trace vertically downward to horizontal for face width W, thence diagonally downward and read on bottom or side scale the amount to be added to inner diameter or deducted from outer diameter to obtain mean diameter for use as D in diagram A. For face widths W greater than 10 inches, divide W by 10 and proceed as above, multiplying result by 10 to get correct value.

OPERATING FORCE DIAGRAM, C.

5. To Find Operating Force P_t or P Required to Give Desired Normal Contact Pressure P.—From proper speed ratio on scales at top of diagram C, trace vertically downward to horizontal for desired normal contact pressure P, thence diagonally downward and read on bottom or side scale the required thrust (axial) force P_t or eccentric (radial) force P_r. Multiply result by face width W to obtain total force required.

Directions in the foregoing concise form are most convenient after the use of the diagrams is understood, but they should be supplemented here by the following examples illustrating the procedures so briefly stated:

1. To Find Surface Speed S:

$D = 14.$ $N = 600.$

Vertical for $D = 14$ crosses horizontal for $N = 600$ on upward-to-left diagonal for $S = 2200$.

2. To Find Width of Contact Face W:

(a) $S = 2200.$ $H = 12.$
$P = 150.$

Locating intersection of diagonal for $S = 2200$ with vertical for $H = 12$, tracing horizontally to the right to vertical for $P = 150$, and thence diagonally upward, gives $W = 6$.

(b) $N = 600$ $H = 12.$
$P = 150$ $D =$ Not fixed.

Locate intersection of vertical for $H = 12$ with horizontal for $N = 600$ and trace thence diagonally downward to left to vertical for a trial value for D, say 14. Proceeding to the right as in (a) gives $W = 6$. If this 14 inches diameter and 6 inches face be an unsatisfactory combination, follow the same downward-to-left diagonal to some other value for D, and then find the corresponding face W; or from a desirable value for W trace backward to this same diagonal and read the corresponding D on the vertical through the point of meeting. Thus, tracing backward from $W = 3.5$ gives $D = 24$; or for $W = 7$ we find $D = 12$. It may be here noted that the horizontal line followed in passing to or from W crosses the vertical for H on the diagonal for contact surface speed S.

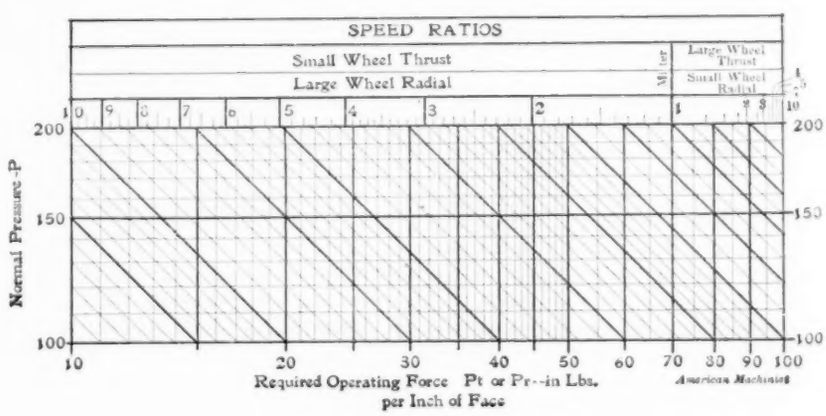


DIAGRAM C—OPERATING FORCES.

3. To Find H or N for a Given Wheel.—

$D = 14.$ $W = 6.$

$P = 150.$

Tracing diagonally downward from $W = 6$ to vertical for $P = 150$, and thence horizontally to left to vertical for $D = 14$, an upward-to-right diagonal through the meeting point will be found to locate the intersections of horizontals for various speeds N with verticals for corresponding horse-powers H. For example: for $N = 600$, $H = 12$, or for $H = 5$, $N = 250$.

4. To Find Mean Diameters for Miters and Bevels.—

Outer diameters: 45 and 16.

Speed ratio: $R = 45 \div 16 = 2.8$.

$W = 6$.

For small wheel, from $R = 2.8$ at left of "miter" line on scales at top of diagram B, tracing vertically downward to horizontal for $W = 6$, and thence diagonally downward, gives 2 to be deducted from 16 for mean diameter, which is therefore 14.

Similarly for large wheel, from $R = 2.8$ at right of miter line, proceeding as above gives 5.6 to subtract from 45, leaving 39.4 as mean diameter.

For $W = 18$ and $R = 2$, using the line for $W = 1.8$ shows 0.8 to be deducted from outer diameter of small wheel, and 1.6 from that of large wheel, or 8 and 16 respectively for $W = 18$.

5. To Find Required Operating Forces.—

Outer diameters: 40 and 16.

Speed ratio: $R = 40 \div 16 = 2.5$.

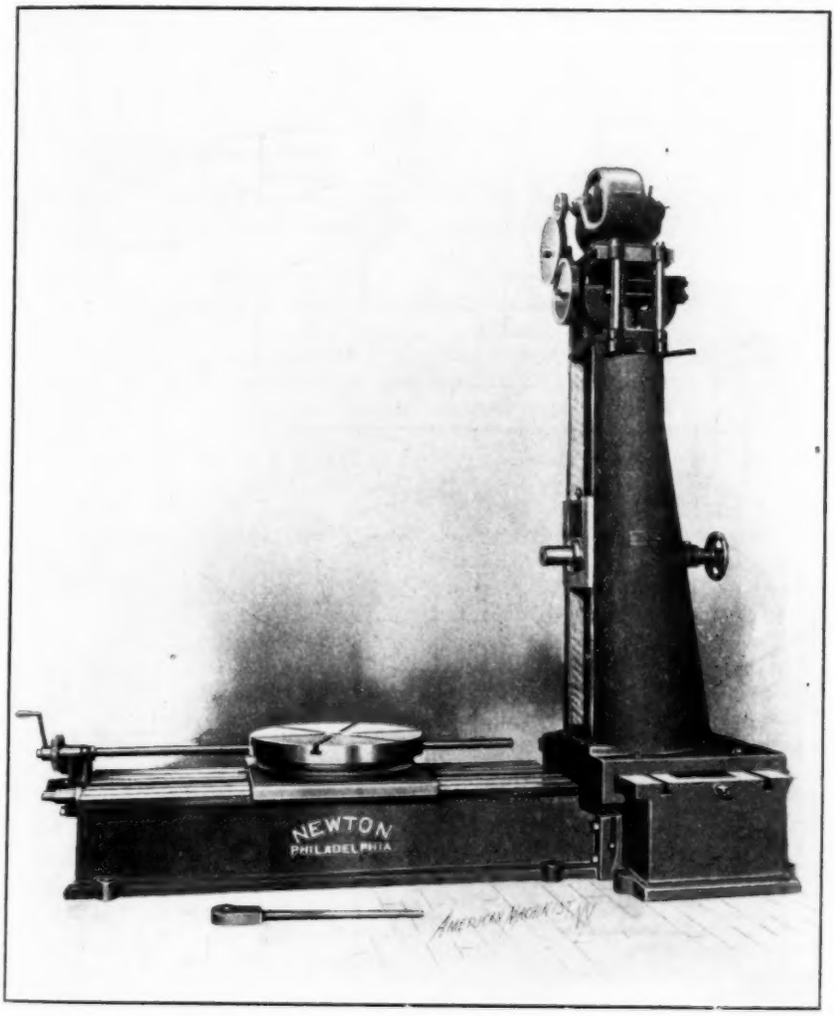
$W = 6$. Desired $P = 150$.

Contact effected by thrust on small wheel.

From $R = 2.5$ at left of miter line at top of diagram C, tracing vertically downward to horizontal for $P = 150$, and thence diagonally downward to bottom of diagram, gives 56 as the required operating force per inch of face width W. Hence for $W = 6$, the total operating force applied as a thrust on the shaft carrying the smaller wheel must $6 \times 56 = 336$ pounds to give $P = 150$.

The radially applied force on the larger wheel will evidently be the same, due to the rectangularity of the shaft axes. On the other hand, contact effected by thrust on large wheel or radially on small wheel would require an applied force of 140 pounds per inch of face, or 840 pounds total.

To write on glass use 1 to 2 parts of silicate of soda mixed with 11 parts of liquid ink. Use a steel pen and wipe it after using.



INDEX MILLING MACHINE FOR ARMATURE SPIDERS.

Index Milling Machine for Armature Spiders.

This electrically driven machine is designed for milling the dovetail grooves in the arms of armature spiders for electric motors, the work being placed on the circular table which is indexed by means of the change gears and crank at the end of the bed.

The motor is mounted at the top of the machine. The spindle which runs in a head carried in the upright has an automatic feed for milling and a rapid power movement in either direction. The upright can be moved across the bed by means of the screw below.

The work table is 36 inches in diameter; the diameter of the spindle is 4 inches and the head has a vertical movement of 5 feet.

This machine is built by the Newton Machine Tool Works, of Philadelphia, Pa.

The Revolutionary Inventor.*

Lest our hosts and their railway guests should be too much set up in their own esteem by this tribute from a duffer who could neither establish an engine works nor run a railway, let me put before them one aspect of their future duty. There is nothing constant but change, and a lot of pestilent inventors are now busy with their brains in the work of destroying the present Baldwin Locomotive Works, and will soon put all these railway magnates to their trumps in their effort to adjust their present cumbrous and costly methods of operating their roads to the more effective and less costly ones that will presently be presented to them. I have no doubt that many of the destructive inventors can hardly get their daily bread, but they cannot help inventing, whether they will or no. The Baldwin Locomotive Works have been in existence for two generations. Is there any building upon the ground which was there in the beginning? Is there any machine or tool in the works which was there even one generation ago? I guess not. Now the profit of each generation has been in saving what the last wasted. The profit of each future decade will be only what was wasted in the preceding decade. Therefore our hosts must be prepared to reconstruct their whole works, to throw all their present tools and machines into the pile of scrap, and to follow the lead of these hungry inventors to see if they can keep up with the progress of science. Let me ask them at the risk of lack of courtesy if there is anywhere in existence a more wasteful machine than that locomotive No. 20,000? Can it convert into work more than 5 or 6 per cent. of potential of the coal with which it is fed? Does it not waste over 90 per cent. of the energy of the fuel? The doom of the stationary steam engine is written upon the walls of the great works in which gas engines are now being made. I doubt if the locomotive can

*Edward Atkinson at the Commemoration Dinner o the Baldwin Locomotive Works.

ever carry a gas-producing plant on its tender, else the doom of the steam locomotive would also be written. Now, let me ask the railway magnates how much energy they are wasting. Even if we do run only four wheels where our kin beyond the sea are said to run sixteen under their little freight cars, is there not still a lot of waste? Even if the old equation of one ton of merchandise to three tons of dead weight in the train has perhaps been trained to three tons of freight to one of dead weight, are you satisfied? How soon will you be forced to change again so as to carry five or six tons to one of dead weight? You are no more free from the nefarious work of the pestilent inventor than our hosts. In the end it all comes to one conclusion. The only accumulation that can be made in this world which possesses any duration or permanent value is mental energy. All that we can save is time, by making a reduction in the hours of labor and in the quantity of muscular effort now required by the work of getting a living. Whether you know it or not, the function of all you gentlemen who are in charge of the great works and great railways is to help on this progress in human welfare. You get your own board and clothing in compensation in common with all the workmen whom you capitalists serve as much as they serve you. In a material sense, our board and clothing is all that anyone of us can get in or out of life upon this planet. If all that the hand and brain of man has transformed of the crude products of nature into what we call capital; in other words, if all our great factories, warehouses, mills, railways, machine shops, goods and wares, could be converted back into food, clothing and shelter, and we then stopped work, we should consume it all and come to grief in less than three years. We cannot beat Old Time by more than two or three years; the sum of all our capital in material things does not exceed three years' annual product now, and probably never will. An old saying is: "Three generations from shirt sleeves to shirt sleeves." That is the common rule. Only those who can leave to their children the power of applying mental energy to the use of their material wealth will lengthen that term. That is the beneficent law of labor, whether the direction of the effort be manual, mechanical or mental. "In the sweat of his brow shall man always earn his bread."

In Detroit they have a steam-operated machine for driving spikes in railroad ties. It travels upon the track which is being spiked, with a hammer for each rail, and each hammer drives two spikes at a time, two blows being sufficient with cedar ties. An important feature of the machine are tongs on each side which hold the tie snugly up to the rail while the spike is being driven. Two men run the machine, and they can spike half a mile of track a day.

Some Jobbing Shop Devices—Drilling Holes on a Helical Casting—Milling in the Drill Press—Special Chuck for Brass Rings—Rounding the Edges of Brass Disks—A Handle for a Templet—Fixture for Milling—Keyseating in the Power Press.

BY JOSEPH V. WOODWORTH.

Fig. 1 shows a drilling fixture, with the work in position, for drilling a 500 lot of malleable iron castings of the shape shown. In these castings it was necessary to drill twelve equally spaced holes *c c c* around the helical portion. The design of the fixture and the manner in which it was used are shown clearly and can be understood without description.

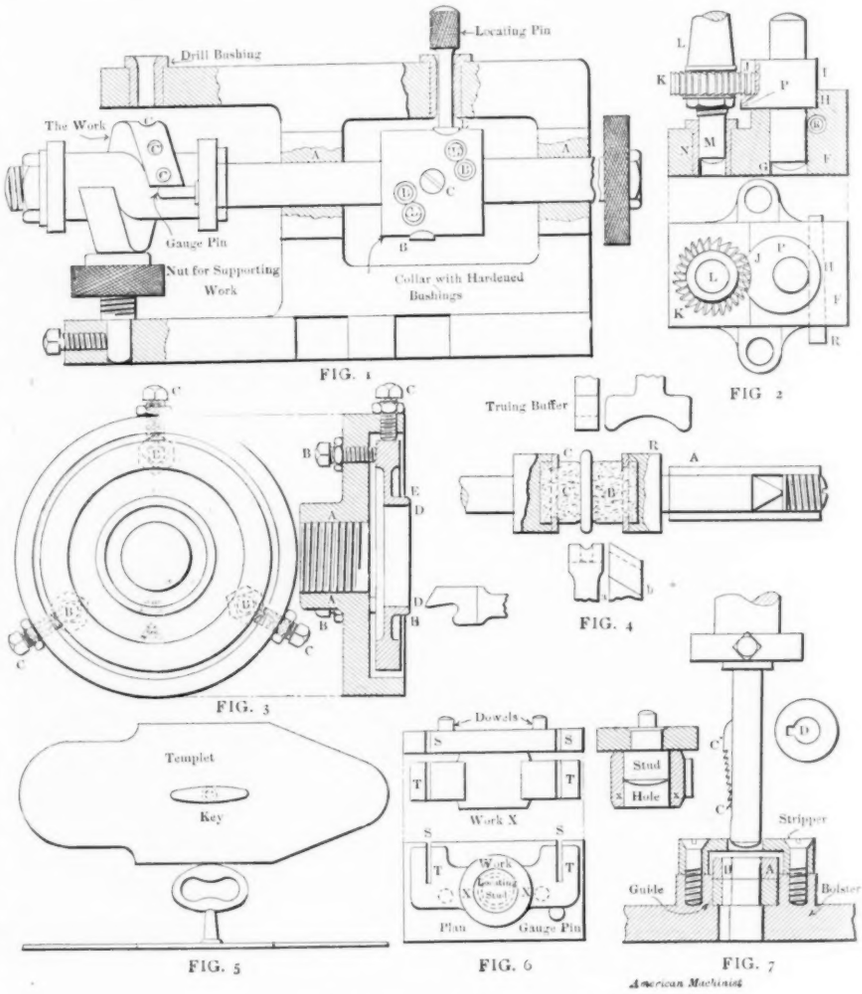


FIG. 1 FIG. 2 FIG. 3 FIG. 4 FIG. 5 FIG. 6 FIG. 7

VARIOUS JOBBING SHOP DEVICES.

The stem *M* of the cutter holder runs i the hardened bushing *N* while the wor is being machined.

In Fig. 3 are two views of a simp chuck used for locating and holding cast brass ring, while the inside at *D* was being bored and the edge *E E* round ed by the tool at the right. There wer a hundred of these rings to be done an the portions designated were the onl points finished. The chuck proper was cast iron fitted at *A* to the lathe spindl and the face bored out for the work, a shown. The three set-screws *B* at th back were for locating the work true side ways while the three around the outside

Fig. 2 shows the use of a small fixture for milling in the drill press a portion *J* out of a small eccentric cam shaft *P*. F is the fixture in which the work is located in the hole *G*. The work is located and prevented from turning while being machined by a portion of *P* resting in a turned depression in the top of the fixture at *H*. A hardened taper pin *R*, with a flat face to bear against the work, secures it, as shown. *L* is the shank of the cutter holder which is fitted to the drill press spindle. The cutter *K* is keyed on and further secured by the nut and washer.

at C were for center truing and holding it. To fasten or release the work it was only necessary to tighten or loosen one of the screws *C*.

The arrangement shown in Fig. 4 was used for rounding the edges of sheet brass blanks 3-16 inch thick and 1⅜ inches in diameter. There were 2,000 of these blanks and they were punched in a plain blanking die. Finishing the blanks by the means available in a jobbing shop was impossible, and for a while we thought that we were "up against it"; but one of the men, who had done considerable mold making

in his time, told of a method which he had seen used with great success for finishing the edges of "poker chips." This method was adopted, with the result that the job was accomplished with ease and at a very low cost. The piece *A* is fitted to a hole in the turret of a small screw machine, with a piece of hard spring rubber *B* attached to the projecting end of the piece *R*. A duplicate of this piece *R* is held in a chuck on the spindle of the screw machine. The rounding tool is fastened in the front tool-post, while the truing buffer is located in the back one. To machine a blank, it is held by the fingers against *C*, while the piece *R* with the rubber front *B* is brought against it by moving the turret up and forcing the rubber against the blank with a light pressure. The truing buffer is then moved against the blank, while it is running, and the blank is trued and sufficient pressure is applied to hold it. The rounding off is then accomplished by the tool, and the blank is released. The blanks were all finished to size in this manner without any trouble.

Fig. 5 shows a little kink which to the best of my knowledge is original. It consists of simply taking the upper half of a brass door key and soldering it to the center of a templet for a handle. When the templet is large, as is the one shown, the soldering of the key to it instead of a piece of wire, is a great convenience. When the die is finished the key can be removed and laid away in one's drawer until required again.

Fig. 6 shows three views of a very simple slotting fixture which was used to advantage for milling the slots *T T* in the casting shown. There were about two hundred of these castings, and they were required to interchange. Before slotting they were bored and reamed at *X X* and the hubs were faced. The slotting fixture consists of a machine-steel plate into which the central locating stud is riveted and two dowel pins are let into the back, as shown. These pins coincide with two holes drilled in the stationary jaw of the miller vise. A gage pin in the front of the plate, at the right, serves to locate the work as required.

Fig. 7 shows the method used for cutting a keyway in the small cast-iron collar at *D*. These collars were used in large numbers and for that reason the means shown were adopted for cutting the keyway. The broach is fastened in a holder, while the collar *A* is located beneath the stripper of the guide bolster. The stripper and locating depression are cut away at the front for placing and removing the work. The guide is of tool steel, hardened and fits the circular portion of the broach snugly. The finishing of the keyways in the power press by the means shown proved very satisfactory, far more so than by the old way of forcing the broach through under the arbor press.

Echoes from the Oil Country.

REPAIRING THE BOILER.

I never knew of a boy striking or jumping his job for want of variety who was turned loose in the little job shop. Variety being the spice of life, life with him would be at times quite spicy.

Among the duties of one such boy was getting around at 6 A. M., cleaning the flues and firing the boiler to have steam up and the wheels turning by 7. Oiling and caring for the engine, as well as the line and countershafts, went with firing the boiler, and running a lathe, planer or drill press, helping load and unload, cutting pipe, running errands, sweeping the floor, and other such matters kept him reasonably busy.

The firing was not very much work, and by a little care it could be looked after without stopping the work being done. The boy had an idea that the shop was run for the purpose of getting out work and that that should be interfered with as little as possible. Some days it was much harder to fire than others, and once in a while a particularly interesting job would claim attention to such a degree that the engine would begin to slow down for lack of steam, or such a combination of work would be going on as to call for more steam. When the large pipe cutter was going the steam was wanted at its best.

On one such occasion there had been several calls for more steam and the boy had been stirred up quite sharply, but, try as he could, things would lag. It was one of those depressing winter days, with the temperature below zero and the smoke and mist hanging low in the valleys. That boiler wouldn't draw and seemed to be sweating even down the smokestack.

The important job on hand was rethreading a string of casing, and a man waiting for it. At the stop for dinner the pressure was run up, but in a short time things were lagging and the boy began to devote all his attention to firing. Every art he knew he tried, including a quite liberal use of crude oil, which he usually reserved for the mornings when for any cause he was behind time in getting up steam. Finally, things got so bad that the owner came and took a hand, thinking the boy needed a little stirring up as well as the fire; but stirring both up did not cut the casing very fast.

Things went from bad to worse so rapidly that finally it was decided to shut down and hunt for the trouble, for it was decided that no amount of dull day and other outside conditions was responsible for that boy's misbehaving.

Trying to follow from effect to cause it was found that the flues were damp and further investigation showed that the water was coming from the back ends of them. As the boiler was a stationary, bricked in well and the building built over it, the back end was up in the machine shop. When the piece of sheet iron that served as a door for the smoke-box was pulled away it was found that the feed water pipe had sprung a leak that spryed the flues nicely. It had got to be quite a leak by this time, too. The boiler was fed with water by city pressure of about 100 pounds, while the boiler usually carried as near 40 pounds as the boy could keep it, so there had been no trouble about keeping in water enough.

It was decided to attend to that leak after supper, which would give some time for things to cool down. The boiler was an old one and in trying to screw out the leaking pipe it was found that there was quite a spot in the boiler around where the pipe screwed in that was too thin to hold a new pipe. The building and boiler were hired by the owner of the shop, so he decided to have the owner of the boiler see the shape things were in before proceeding with repairs, as it was considered that such repairs belonged to his part of it. The matter was urgent, as that string of casing was promised *sure* for the next day.

Outside it had grown bitterly cold, and, in truth, inside it was not very much better, as the shop was a light frame affair set up several feet from the ground on pins, while daylight could be seen in almost any direction through roof, sides or floor, if looked for when there was any daylight. I have ceased to wonder that some of the men who got jobs with us did not stay long.

The boy had been helping around as best he could with all the work, clad in overalls and an old coat, and, boy-like,, had managed to accumulate his full share of soot, water and grease until his teeth and the whites of his eyes were about all that could be seen that were white. In this state he was directed to go and get the owner as quickly as possible.

The time was now about 8 o'clock, and the owner, being a devout man, would be found at a fine church in the vicinity at prayer meeting; if not there he was to be looked for at his home much farther away.

The boy did not exactly desire to plunge into a prayer meeting in this condition, but to clean up and wash would take a long time and prayer meeting might be out and the owner might refuse to return if he once got home. The orders were "Go to the church and bring him back with you."

There was only thing for it, and an old pair of mittens were picked up and the boy started on a trot for the church, trying to shake and stamp off as much loose dirt as he could as he went. Arriving at the church he opened the door softly and found himself looking into a large dimly-lighted entry. After scraping his feet as clean as he could, he went in and closed the door and crossed to another door and tapped, not wanting to go walking in. In truth, the big problem in his mind on the way to the church was how to get

that man without making it look like a call from his Satanic Majesty, churches and good clothes and dignity being so linked together, while in the shop it was quite the reverse.

After the second rapping, which sounded very loud out in the entry, the door was opened and a man looked out. The mingled look of awe, amazement and hesitation that swept over his face on his first getting a view of the messenger told who that messenger resembled in his mind, but as no hostile demonstration was made against him he advanced into the entry to find out why this unheard-of apparition.

It did not take many minutes to get the man that was wanted and get back to the shop, where it was decided to cut out a piece, put in a hand-hole plate and put the water pipe in another place.

"But you might as well go to bed now, as you can't do anything to-night," said the owner of the boiler after he had agreed to the repairs.

"All right, you go home and go to bed, you have done your part; this shop will be running in the morning. Good night." "Here, boy, you go up the street to the big house beyond the boiler shop, and in a little cottage three or four doors beyond you will find Jack, the boilermaker. Bring him back with you if he is at home; if he isn't, find where he is and hunt him up and bring him. If he's up that way, tell him to bring a couple of large hand-hole plates from the boiler shop as he comes by. Hurry up, now, and get him while I tear out the brick work at this end so he can get in to work." This from the shop owner.

Fortunately the boilermaker was at home and in bed. It took hard work to convince him that anyone wanted him at that hour on such a night, but he likely thought it better to go down and see than to argue the question all night with a thick-headed youth who only seemed to know that he must not return to the shop without a boilermaker, so he got ready, growling and shivering.

After looking the job over, a trip was made to the boiler shop and a plate of the right size was found. Of course it called for an odd-sized bolt, so that had to be forged with the boy as helper and a grimy torch as light, an old pair of jaw plates (the man that thinks rolling threads on bolts and screws is an entirely new process should try threading with the old, old screw plates) squeezed a thread on.

"Hurry down to the tobacco store and get a large-size package of Durham tobacco; it's about time for them to close." That was soon done.

"Do you know where Hall, the bricklayer, lives, over on First street? Yes, well you go over and rouse him out and tell him to come over here not later than 2 o'clock, and to bring some lime and a few brick, then you can go home and go to bed, and be here at the usual time in the morning" (6 A. M.).

"What if he won't come?" said the boy.

"He'll come if you tell him plain enough," said the man. "He must come; we can't afford to disappoint our customer." "If he isn't at home, or is sick, or won't promise to come, I will come back over and tell you." "Yes, and borrow his trowel and bring over what lime you can wheel and a few bricks."

Fortunately Mr. Hall was at home, and much more reasonable than might have been expected of a man roused out of his first sleep; but bricklayers' business is not rushing in winter, and after getting his promise to be on hand promptly the boy turned his steps toward his home on the hill. Staying with a job until any hour of the night was no new thing to him.

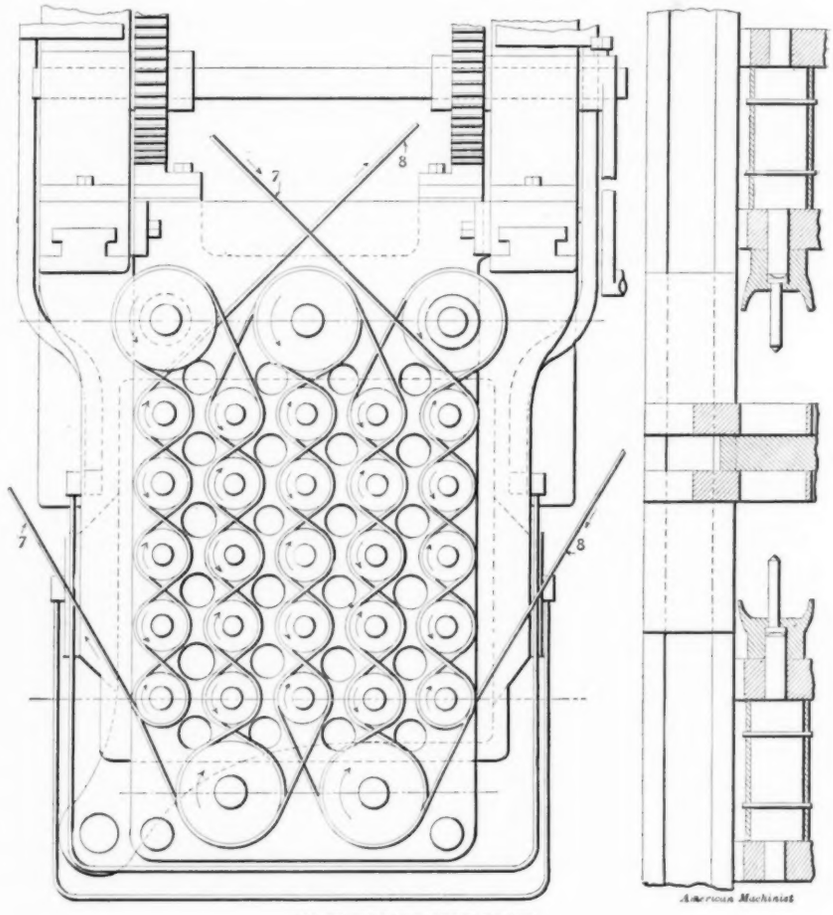
Six o'clock in the morning found him at the shop, when the bricklayer was loading his stuff into his wheelbarrow and the shop owner was watching a small fire under the boiler, giving it all he dared without spoiling the newly laid brick work which fortunately was a good ways away from the fire.

The shop was a little slow in getting started that morning, but under the circumstances it was hardly to be wondered at, but 8 o'clock found everything going in full blast and all hands (the one man and the one boy) hard at work trying to keep the world moving.

W. OSBORNE.

An Intricate Belt Drive.

The cut shows the plan of an intricate and ingenious belt drive embodied in a recent patent for a machine for turning small wooden caster wheels in large quantities. There are twenty-five (or rather double that number) of small vertical spindles to be driven, and as they are to be driven at a very high speed toothed gearing would be impracticable. The style of the spindles and pulleys is indicated in the partial elevation and section at the right. Each pulley is long and is divided into three sections by the two rings, the middle section being wide and the other two sections being narrow. All the spindles are driven simultaneously by the belts 7 and 8. The belt 8 runs on the wide



AN INTRICATE BELT DRIVE.

section of the pulley in the middle, while the belt 7 is in fact two narrow belts which run on the two narrow sections of the pulley. By carefully tracing the course of the belts in the plan it will be found that the belt 8 passes around one side of every pulley of the series, while the belts 7 pass around the other sides of all the pulleys, thus not only providing an effective drive, but also balancing the pull of one belt by that of the other and relieving the bearings of the side pressure to which with a single belt they would be subject. The five large pulleys are of course idlers. The driving pulleys for the two belts are located on opposite sides of the machine.

Hardening Long Reamers.

BY E. R. MARKHAM.

The superintendent of a fairly prosperous shop came to me a short time ago, asking if I could recommend a good man to harden tools. The principal qualifications that he wished the man to possess were: that he must be a hustler and he mustn't be "sassy." I told him I thought all the good hardeners I was acquainted with had good positions, and, what's more, they all were averse to hustling. Not but that a hardener should be willing to earn his money; but he can do it in a more common-sense way than by letting his blast on full tilt when he has a piece of work in the fire that cost a good round sum to make.

If a reamer costs $3 to make, up to the time it is hardened, the hardening costs 25 cents and the reamer is then thrown away, or if it costs $1.50 to get it into such shape that it can be saved, and then probably give results anything but satisfactory, on account of our having to draw the temper when straightening it, thereby reducing very appreciably its wearing qualities, would it not have been better to have taken some method of hardening that would have given more satisfactory results, even though it cost a little more to do it?

But the fault isn't always in the hardening or the method of hardening. When a reamer or similar tool comes out of the bath looking like a cow's horn, it may be due to one or several causes with which the hardener has nothing to do.

I will give the method I have used in an experience of sixteen years in charge of toolrooms and hardening plants. I have first exercised a great deal of care in the selection of the steel. I do not mean by that the particular brand, but as to whether the steel was adapted to the particular tool I was to make. If a man was to make a track chisel, or similar tool that was to receive particularly rough usage, he would not select a steel known as razor temper, containing 1½ per cent. carbon; neither would he select an extremely low carbon steel if he were to make a milling machine cutter that was to be heated in an open fire for hardening.

Now, by the method I am to describe it is not necessary to use the *highest carbon* steel when making taps or reamers. I do not mean by that that it is advisable to use a cheap, low-grade steel. Use a good quality of steel of a medium temper.

Use stock somewhat larger than the finish size of the reamer. If it is crooked do not attempt to straighten it cold; heat to a good red and straighten. Steel straightened cold has a tendency to spring back when hardened. Center it carefully. By this I mean have your center near the center of the stock. The reason for this is that the outside of any bar of tool steel as it comes from the mill is decarbonized to a certain extent on the surface, and extending in some distance. If the piece is centered so that this decarbonized portion is removed entirely from one side and not from the opposite side, the surfaces will harden unevenly, and if one side is harder there must also have been an unequal contraction on the opposite sides, causing the piece to spring.

A roughing chip should be taken from the surface of the piece deep enough to remove all the outer coating. It should then be packed in an iron box with granulated charcoal and put in a hardening oven and run for a sufficiently long time to have the contents of the box red hot throughout. The box should be left in the oven until cold. When the piece of steel has been taken from the box, it may be machined to grinding size if it be a reamer, the flutes may be cut and the reamer made ready for hardening. Before the final turning try it between centers to see if it has sprung in annealing. If it has to such an extent that it will not turn out before it is to size *do not* straighten cold. My plan has been to lay it aside and make a tool of a smaller size, but if it must be straightened heat it to a red when doing it. I would say here that the object of the annealing mentioned was not to soften the steel, but to remove the *strain*, or tendency to spring, that is in all steel as it comes from the mill. If this steel is annealed ever so soft with the scale on, it cannot take the shape it would if the scale were removed, and it is better to have it spring in the annealing, when there is probably stock enough to machine out, than when it is hardened and we have only .010 or .015 inch to grind.

When machining in the lathe and milling machine we should see that no dull tools are used. Particularly is this true of the milling machine cutter, as it operates on only one side at a time, and if dull will stretch the steel on that side and spring it. If the reamer is slender the support provided with all universal milling machines should be placed beneath, to prevent the pressure of the cutter from springing it.

When ready to harden, select a hardening box at least 2 inches longer than the reamer. Put a quantity of pounded or granulated charcoal in the bottom, have this at least 1½ inches deep, then put in a mixture of granulated charred leather and granulated charcoal, equal quantities, about half-inch deep. Place the reamer on this and fill in around with the mixture mentioned, having it about 1 inch on the sides and top. Fill the rest of the box with pounded charcoal, put on the cover and lute the edges with fire clay. The cover should have several holes drilled near the center; quarter-inch holes will do. Put some pieces of 3-16 inch wire down through these holes to the bottom of the box. Place the box in the hardening furnace and allow it to run for a time (according to your judgment) nearly sufficient to heat the box to a red heat throughout. Draw one of the wires with a long pair of tongs or a pair of regular length, leaving a piece of gas pipe on each leg as an extension. If the wire is hot, begin to reckon the time from then; if not, wait a while and draw another wire; and so on until one is drawn that is red the entire length.

The work should run for a length of time after this, depending on the size of the work and how hard it is necessary to have it. Reamers, ½ inch and under 1 hour; ½ inch to ¾ inch, 1½ hours; ¾ inch to 1 inch, 2 hours; 1 inch and over, 2½ hours. At the end of this time the box should be removed from the furnace, the lid removed, the packing material above the reamer taken out with a long handled ash shovel. With a suitable pair of tongs that will grasp the shank firmly the reamer is removed from the box and immersed in a tank of oil, preferably raw linseed, although sperm works well, but does not leave the surface as hard as the linseed oil does.

This at first thought may seem like a costly way of doing, but if a few pieces are hardened at a time it reduces the cost to a level with open-fire-and-water work. If sufficient quantities of work are done at a time, the cost is much less than that of the method generally used. And the results—well, the results are not to be compared if proper care is used. The work when being heated for hardening need not, and should not, be heated above a low cherry red.

Do not under any circumstances use anything in place of the leather. Tool steel should be as free as possible from phosphorus. If any packing material is used containing any of this impurity, we undo what the steelmaker has endeavored to do: we incorporate into the steel elements which make it brittle.

If this method is to be used—and if once used in the proper manner it will never be discarded—it is best to fit up to do it in a businesslike manner. We should have a suitable hardening furnace, one that will maintain an even heat for any length of time. Our boxes should be of suitable sizes and shapes. If long articles are to be heated, it is advisable to have b xes which open at one end. The box can be placed on end when packing, and also when the pieces are removed. This does away with any tendency to spring which might exist were they to be lifted in the horizontal position by one end with the packing material bearing on them. When a quantity of small tools are packed in a box, they may be wired with iron binding wire, the end of which may be placed over the outside upper edge of the box; the luting of fire clay will keep them from burning off.

The bath should be deeper by 10 or 12 inches than the longest piece we intend hardening, so that the work may be moved up and down well in the bath to insure even, satisfactory results. If the bath is to be used very much, it should be of generous size, and placed in a tank of

running water. A suitable pump should be connected with the tank and the oil should be pumped through a coil of pipe in a tank of running water and back into the bath, this circulation of the oil keeping it cool.

I had at one time, in a hardening plant that I had charge of, three large baths, each holding 42 gallons of oil. Each of these was in a water tank 4 inches wider on each side and 12 inches longer each way. They were supplied with running water. The oil tanks were placed so that the tops were about 3 inches above the tops of the water tanks, so no water could get in. A pump large enough to supply a generous stream of oil passing through the coils of pipe in the water tank was provided for each bath. We were never obliged to wait for the oil to cool, as it was always at a good working temperature.

Reamers hardened by the process described do not need to have the temper drawn, provided the lands are as strong as reamer teeth should be made to enable them to cut without springing.

If the above instructions are carefully followed, it will not be found necessary to straighten a reamer after hardening; at least that has been my experience, and I have had thousands of reamers and similar tools hardened by this process.

If the instructions given prior to the hardening operation are followed where reamers are to be hardened by the fire-and-water process, the tendency to spring will be reduced very materially, especially of the articles are dipped in lukewarm brine, instead of *cold* water.

I would say in conclusion: When dipping work in the bath, if the article is long and has an equal amount of stock on opposite sides, hold it in as nearly a vertical position as possible when dipping.

Good American practice allows one square foot of surface in condensers for every 10 pounds of steam to be condensed per hour with a vacuum of 25 inches of mercury and an initial temperature of 75 degrees Fahr. for the cooling water. About 25 pounds of water per pound of steam is allowed, and the condensed steam is reduced to a temperature of about 120 degrees Fahr. This amounts to heating 25 pounds of circulating water from 75 degrees to 116 degrees Fahr. per one-tenth square foot of surface per hour with steam at 138 degrees Fahr.—*The Engineer.*

Lord Kelvin says that power can be electrically transmitted 300 miles, using a pressure of 80,000 volts. While staying in Rochester, he formulated a scheme for using all the power of the Genesee River by constructing dams at various points with turbines and 2,000-volt generators connected in series on a single wire not more than ½ inch.

Letters From Practical Men.

The Friction of the Line Shaft—Making the Gage Fit the Work.

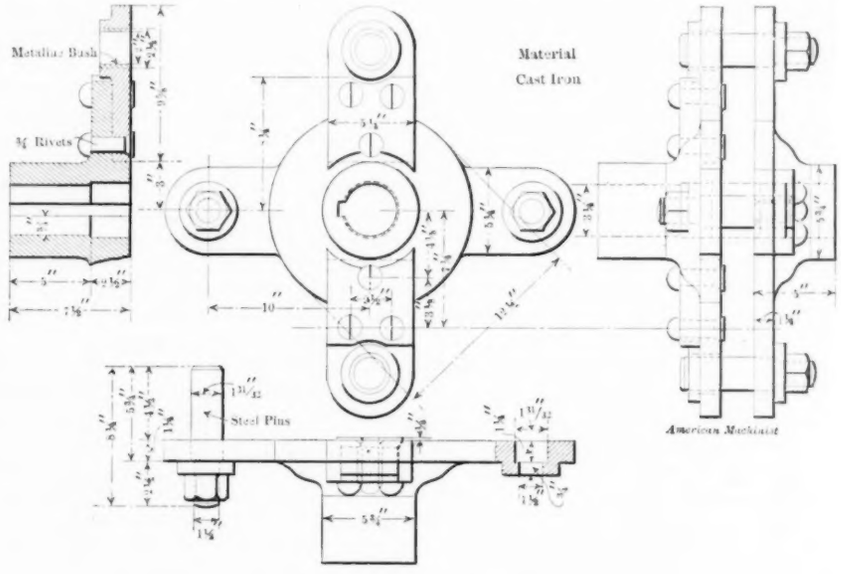
Editor American Machinist:

At page 592 Mr. J. H. Dunbar draws conclusions and makes criticisms that I think are not fully justified. As to the power taken by that line shaft, I might have stated that, under normal conditions, about 30 per cent. should be charged to the engines and the rope drive, which is a rather long one. The alinement of the shaft is far from perfect, but I do not see how that can affect the comparisons that I attempted to suggest.

Mr. Dunbar has cited, as a like case, a locomotive with its summer and winter loads. Can he tell us about how much difference there is in the load that a locomotive can start on a straight and level track in summer time and the load that the same machine can start on the same track when the thermometer is at 20 below? What I thought would be of interest to your readers was the large amount of power required to *start* the shaft, and the comparatively long time before normal conditions were reached.

As to means of taking care of the contraction and expansion of the line, we, at the time of putting in the plant, specified and put in jaw couplings at intervals of about 180 feet. These very soon wore, so that the back lash became annoying, and they were thrown out. At three places we put in cut-off couplings of the cylindrical ring style, and at two other points we have expansion couplings. The smaller one of the two is shown in the accompanying drawing. This arrangement is very satisfactory. The first expansion coupling we put in did not have the self-oiling bushings shown on the print. The pins and their bearings wore very fast, although we tried to keep them lubricated. Our trouble in this direction has ceased since putting in the metaline bushings. For fear of drawing down on my bald head more unkind criticisms, I shall not say why I used rivets instead of casting all four arms solid. The larger coupling has no rivets.

I think it was Osborne who in a late number told us of his experience in fitting a coupling to a shaft, and how he left it, expecting to hear from it again, but wound up by telling us that it is still in place, or was when he last heard of it. This reminds me of a somewhat similar experience that I had during my first year in the shop. I had a lot of sleeve flanges to bore and turn for a sawmill that was being built near the shop. One of these sleeves was about 20 inches long, and was to go on a shaft about 6 or 7 inches in diameter. Because of its length it was decided to bore it as we did steam cylinders, by bolting it down to the carriage of the lathe and using a boring bar (I had then never seen a bar with traversing cutter). Somebody at the mill had sent in a gage made of ¼-inch round iron, to which I was to bore the sleeve. After the bar was in place it was of course necessary to transfer the size first from the gage to outside and then to inside calipers. As events proved, this required more skill than I then (or possibly now) possessed, and after I had taken out the bar I was startled to find that the gage could be rattled around in that hole almost any old way. Most of the time we had no foreman, and I think there was none around then. At any rate it did not take me long to make that gage a nice fit, but I cannot say that my conscience felt as nice, and it was only when several days had passed without my being called to account that I felt anywise easy. I happened to meet the machinist who was putting the shafting and pulleys in place after the mill had started and I asked him



AN EXPANSION COUPLING.

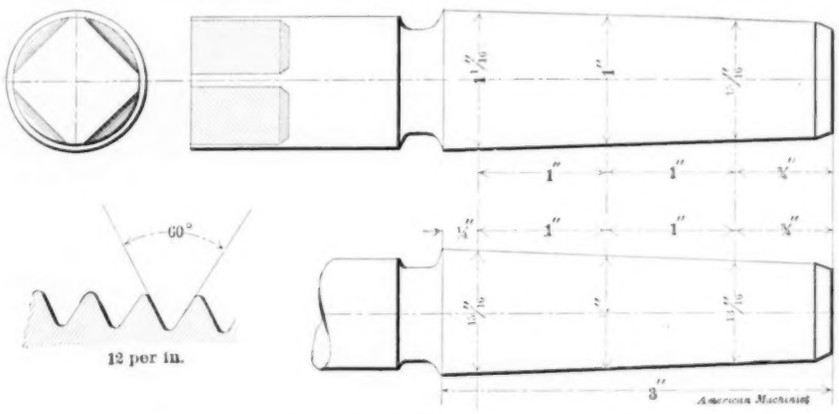
how those couplings fitted. The answer was, "All right." "How about the long one?" "Oh, it slipped on just right."

I have related this, not as a matter to be proud of, but to suggest that perhaps either the shaft or the sleeve was as crooked as our Buckeye friend thinks my line shaft is. TRANSMISSION.

A Proposed Standard for Taper Taps for Boiler Fittings.

Editor American Machinist:

Anyone having to do with the making of tools to suit railroad mechanical engineers' specifications will appreciate the great saving that would follow the adoption by all railroads and builders of boilers, tanks, etc., of a standard fitting. By fitting is meant anything that is screwed into the shell requiring a steam or watertight fit, as cocks, gages, plugs, studs. The mechanical trades could not get along without the United States standard for bolts and nuts, and the Briggs standard for pipe joints, poor as it is, is infinitely better than the "any old thing" that existed prior to its adoption.



PROPOSED STANDARD FOR TAPER TAPS FOR BOILER FITTINGS.

In looking at the present condition of boiler fittings we will first consider the taper. This we find varies in actual practice from ¼ inch in 12 inches to 1 inch in 4½ inches. Second, the number of threads per inch runs from 6 to 27, as follows: 6, 7, 8, 10, 11, 11½, 12, 13½, 14, 16, 18, 27. Third, the shapes found are: Sharp V, United States standard, and Whitworth standard. The proposed standard as recommended would have: First, the same taper that pipe ends are made, ¾ inch in 12 inches; second, the number of threads per inch, 12; third, the shape, 60 degrees, rounded top and bottom, same as Whitworth standard.

Now for the reasons the above are suggested: The taper ¾ inch in 12 inches has been found in practice to work easier and with less risk of stripping or tearing the thread, especially in boiler steel, even when enlarging, than any other taper; it being the same as pipe ends, it is easily remembered; also it is readily turned on all lathes. It is also easy to measure, increasing 1-16 inch in diameter for each inch in length. Taps with 3-inch length of thread would hold an even thread, say 1 inch, and also make 1-16 inch over and 1-16 inch under (see sketch), permitting a set of taps made in even sizes, say, by eighths of an inch, to overlap.

The 12 threads per inch is suggested for the reason that it is easily machined, suiting the average screw-cutting lathe with either 4 or 6 thread lead screw to throw in on any thread. It is amply strong for the purpose, and has been found less liable to strip in boiler plate than finer or coarser pitches. It also has been adopted by a number of the leading railroads.

Again, the hole to be threaded being drilled exactly ⅛ inch less in diameter, makes it an easy matter to have and maintain standard taper reamers with stop collars, so that cut-and try methods are done away with.

The shape, rounded top and bottom, offers a strong and well-wearing form, much easier to produce and more durable than either the sharp V or the United States standard when struck in handling, and it will not abrade when tightly screwed in a hole. The angle, 60 degrees, is selected for the reason that it is easier to keep up, being the same as the United States standard. It must be borne in mind that this is not to take the place of the Briggs standard, but is for cocks, gages, plugs and studs—fittings other than pipe.

It seems to me that much of the queer tapers and odd numbers of threads have been made owing to carelessness on the part of someone who has measured a plug or a hole with an old two-foot rule and sent the error to the drawing room.

This suggested standard will no doubt be opposed, for every designer has some reason to believe that his taper, number of threads and shape of thread are the best. An expression of opinion on the subject by those interested would be welcome, and thereby we might some day find a standard acceptable to all. H. E. B.

Philadelphia.

A Regular Inventor and His Day Off.

Editor American Machinist:

I have never seen anything in your paper about *hobbies*, and as a great many machinists have them and as they are still cropping out I think it would be a good idea for you to look up some of them and see if other machinists cannot be interested.

In Olean, N. Y., going into a shop making stump pullers I noticed a very old man with a drawing board on his knees sitting out in front of the office. He did not notice me, so I went inside. After introducing myself to the office man, I asked if the gentleman in front was the proprietor and was told that he was not. I suggested he might be a mechanical engineer and was informed that he was not but was an inventor. "What is he inventing?" "He is working on a cyclone arrester." I laughed, and said, "How is he getting along?" "Not very well," said the office man. "How long has he been working on it?" "Since about 1844." "Does he think he will get his machine in working order?" "Yes, if he could only see a cyclone he is sure he could get it to work."

Then the office man drew me out and showed me he wanted to carry on the conversation, and I asked if the man had ever invented anything else. "Why, yes," said the office man. "He took a day off along about 1860 and invented a car coupler." That was enough, and I was about to go out, but was held by the office man and asked if I ever saw on one of the old passenger cars a plate on the platform reading "Miller's platform and couplers." "Well he is Miller. He took a day off and made drawings of it and turned it over to a patent attorney and the next day was working on the cyclone arrester. The strange part of it seems to be that the patent attorney divided profits with Miller."

I cannot swear that the above is correct, but it is just as I got it. If one of your men should be in Olean it would be of great interest to me and lots of your readers to investigate this case and see if it is whole. And as Miller certainly helped anyone who is old enough to know how much he improved on railroad traveling they may be pleased to know how little he cared. CHAS. W. SHARTLE.

Middletown, Ohio.

Making the Milling Machine Cut Both Ways.

Editor American Machinist:

While timing a milling operation I was surprised to find that the time required to run the table back after each cut was almost 25 per cent. of the total time consumed. The pieces were copper strips 8 inches long and ⅜ inch wide and had a cut taken the entire length. I decided to make the mill do what the tramp sometimes does—work its way back.

Two mills were placed side by side on

the cutter grinder and ground to the same diameter. They were then put on the milling machine arbor—one to cut to the right and the other to cut to the left. When one cut was over the work was removed and another piece put in. The work was shifted to come under the other cutter, the machine was reversed and the mill cut back to the other end. In this way five pieces were done in the same time it had previously taken to do four.

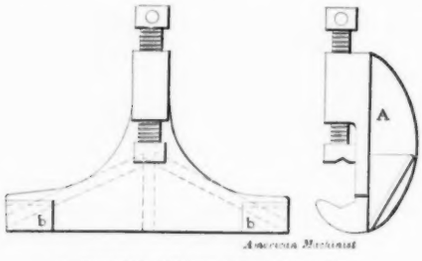
This method can be used where longer pieces are milled, at a greater saving of time. W. H. LEHMAN.

About Straightening and Bending.

Editor American Machinist:

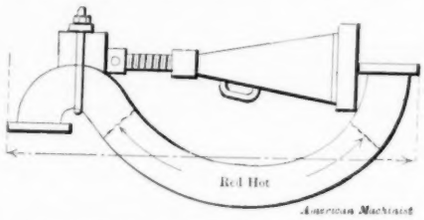
When I read Mr. Osborne's letter about straightening by peening it reminded me of several instances of my own experience, which, however, were not quite so satisfactory. I think there are very few old machinists who have not used this method of straightening more or less, and in some cases it can be used to good advantage; but if the article so straightened is subjected to any amount of strain, it will be found that the peening will generally let go again. Anyone who has ever done any straightening on a press well knows how easy a shaft will spring in the direction of least strain. I refer to the use of a screw press, where any difference in the resistance can be readily felt on the lever. I always make it a point when straightening a shaft in this way to bend the shaft in the opposite direction, and then when it is straightened it is just as stiff in one direction as in the other. In other words, the strains are neutralized, and the only thing that will then spring it is the application of some external force. I suppose this is somewhat in the nature of "seasoning," as described some time ago.

There was a line shaft of three lengths up in the seventh story of a big building that ran out very badly, and as it had to be taken down to change some pulleys anyway, we took it to the shop to straighten and face the couplings. As we only



A HANDY SHAFT STRAIGHTENER.

had a small straightener, and this shaft was 2¼ inches diameter, we had to resort to peening; but we tried to make a good job, as the other tenants of the building had been doing lots of kicking on account of the vibration. To get the shafts in place again they had to be taken up in the elevator and carried through several rooms and passed over partitions, and when we started up they wobbled just a little worse than before. The owner of the building, who stood by, expressed himself with more force than elegance about machine shops and machinists being robbers and greenhorns, and other things not at all complimentary to the trade, and I was half inclined to agree with him. Well, we uncoupled again and tried the shafts by turning each length separately in two hangers, and I found, as I expected, that the peening had let go again, so we peened some more in the same places until we had them straight again, coupled up, and they ran pretty decent.



STRETCHING A CAST-IRON STEAM PIPE.

I was satisfied that they would not stay straight very long, so I had a straightener made somewhat like the sketch, the frame *A* being a steel casting. It was not very long before we used it on that job, and we straightened the shafts in place, and this time they did stay. We now use the clamp regularl , in the shop and out of it, for this kind of work, and it has long ago earned its cost. The space between lugs *b* is open below, so that heavy work can still be peened with a hammer. Be sure to bend too much, and then reverse the clamp and you can easily feel how stiff the shaft is.

In straightening cast iron, however, I use a method that is somewhat different. We have all seen cast iron that has passed through fire and that has been bent and twisted into all sorts of shapes. A grate bar is a common example, and others will suggest themselves to readers, according to their experience. I find that anything that has been bent while red hot will straighten under the same conditions, and the strains set up in the process will be much better distributed than by peening. A wheel that has been shrunk on an axle can be easily loosened by merely heating to a red and allowing it to cool, as the strains are all removed, much the same as in annealing a piece of tool steel several times after cuts, to avoid springing when tempering.

I once helped myself, or rather the other fellow, out of a pretty bad hole by using this kind of reasoning, or guessing as some may call it. You see there was a boiler shop in connection with the shop, and the jobs were few and far between that we did not get a try at; so when a locomotive came along and wanted a brand new boiler and a fixing up generally, why, we tackled it as though we had 'em regularly for dinner. A fellow gets used to such things in these job shops where every job is a little different from the previous one. She was a 16x24-inch standard, and pretty nearly filled the shop. Well, everything went well till we were nearly done, wheels under, cab and fittings in place, valves set and about ready to run out. I had all the joints on the steam pipes faced and ground and new packing rings for the joints to the nigger-head and cylinders. The cylinder joints for the steam pipes were in a vertical plane as well as those on the nigger-head, and when we placed the steam pipes we found that they were nearly an inch too short to make the joint; the hole in the front flue sheet was that much too high.

Well, it was out of the question to do anything to the flue sheet, as this would necessitate a removal of most of the flues, and on account of the vertical joints we could not do anything there. Fig. 2 shows how we stretched the pipes. I had a good fire built in the flange forge and got a good red heat on the pipe about the middle for about 2 feet. I then took the length with a big pair of calipers and applied the jack screw as shown. That pipe opened up just as though it was made of molasses candy, and when the caliper showed ¾ inch we stopped, but left the jack in place until the color disappeared. Meanwhile the other pipe was in the fire and was soon treated in the same way. We were careful not to heat or injure the joints, and when the pipes were bolted up and the steam was turned on there was no sign of a leak. These pipes were about 6 inches outside diameter and ¾ inch thick. I was in some doubt whether they would go that much without breaking, but results fully justified the risk taken. GEO. J. MEYER.

Milwaukee, Wis.

Case for a Steel Square.

Editor American Machinist:

I send herewith sketch of a very useful and simple attachment for a 2-foot steel square. Machinists, patternmakers and carpenters who use a square of this kind will find this attachment or case a valuable addition to their kits. The writer has a square fitted with this attachment which

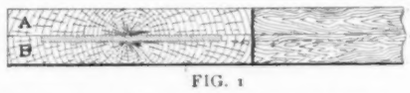


FIG. 1

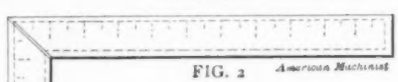


FIG. 2 American Machinist

CASE FOR A STEEL SQUARE.

has been used the past two years in machine shop for laying out and measuring up very accurate work.

The heads are made of maple wood, Fig. 1 showing the method of construction. The two pieces *A* and *B*, ¾ inch longer than blades, are glued together. *B* has a recess deep enough to let in blade.

The blade being parallel on sides and

having a slight taper on flat makes it convenient to secure a neat wedge fit. Fig. 2 shows the heads as a case or cover preserving and keeping the square bright. The removing or replacing of one or both heads can be done in an instant.

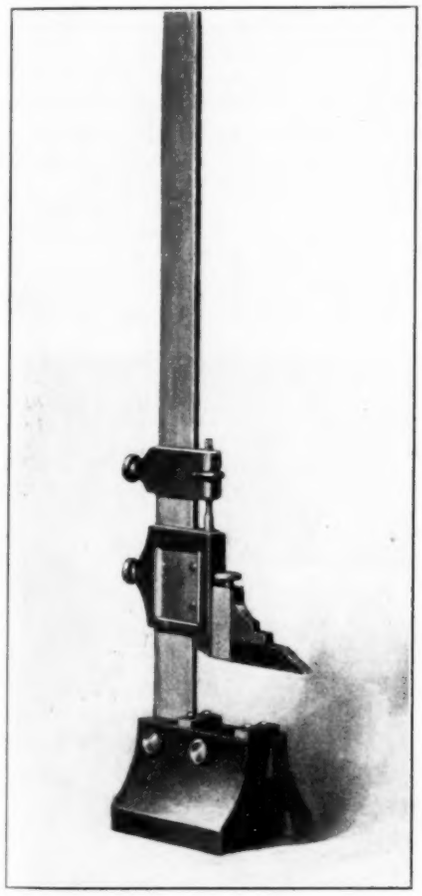
FOREMAN.

A Vernier Caliper as a Hight Gage.

Editor American Machinist:

The illustration herewith shows a vernier caliper fitted with an attachment for converting it into a hight gage. The attachment is a very desirable addition to one's private set of tools; also advantageous to the health of one's pocket-book, as it saves the investment of $25.

I call this a new use for a vernier caliper. Perhaps I ought not to do so, as there is a possibility that in some later number of the AMERICAN MACHINIST I will be informed by someone that his grandfather, who worked in our friend Osborne's shop, used this same tool to assist him in determining why the pump did not work.



A VERNIER CALIPER AS A HIGHT GAGE.

Nevertheless, since he has not shown it in the columns of this paper he has left it for me to do. No doubt it will be new to a great many; therefore, although hardly necessary, I will give a brief description.

The base is a block of tool steel shaped to the form shown, with a slot in the center 1-32 inch wider than the jaw of the vernier, to allow for a gib against which the two screws act. The gib is fastened by a block in the front end. On top of the block two small plates are screwed fast; the front one with which the measuring jaw comes in contact is hardened, ground and lapped and has corners recessed to prevent dirt collecting. The rear plate has a pin riveted in the center to compensate for the recessed jaw of the vernier. Underneath the slot in the groove is a small thumb-screw to tighten the jaw against the two plates. The block is hardened, ground and lapped to exactly 1¼ inches, and the scriber, being ¼ inch, the difference between the vernier reading and actual measurement is exactly 1 inch.

The construction of the scriber point is not just right, as the right measurement is not in the center of the line scribed, but at the extreme under edge; but this defect is not of any consequence if the scriber is kept perfectly sharp with an oilstone. For scribing lines on jigs or measuring projections from a plane surface this tool cannot be beat.

SAN FRANCISCO.

A Triangle at the Tool Room Window.

Editor American Machinist:

How many readers of the AMERICAN MACHINIST have had to wait at the toolroom window until the boy's attention has been attracted to their presence either by shouting or throwing an old nut at him? A shout does not attract much attention in a machine shop, and it seemed to me that a little scheme I saw the other day was a good one. It was just a little tool-steel triangle suspended in the toolroom window. When this was tapped by the bar hanging beside it, a note alien to all the noises of the shop demanded immediate attention.

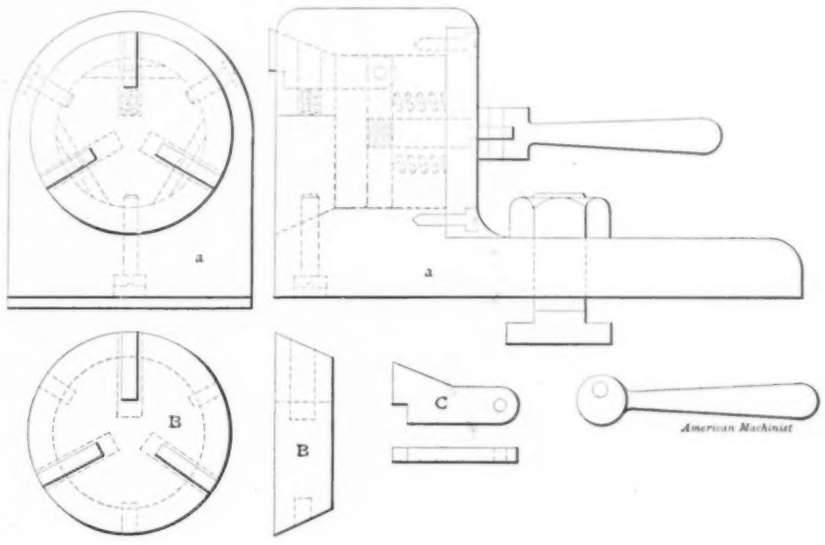
F. W. HARRIS.

A Handy Milling and Grinding Fixture.

Editor American Machinist:

The sketch herewith illustrates a fixture for face milling work of either round or irregular section. It is bolted on a milling machine and will mill pieces much faster and more accurately than they can be faced in a lathe. In the large casting *a*, which is bored out taper in front, is fitted the taper piece *B* which has three 3-16 inch slots milled in it for the jaws *C*. These jaws are connected with the eccentric lever in back, as shown in the sketch, and when the lever is tightened the jaws clamp the work and draw it up against the face of the fixture, thus insuring true milling. These jaws can be made to hold a large variety of pieces having irregular outlines. As this fixture can also be used on a disk grinder for grinding flat pieces, it will be found very useful.

B. W.



HANDY MILLING AND GRINDING FIXTURE.

Huber System of Dies Using Hydraulic Pressure.

Editor American Machinist:

At page 1364, Vol. 24, you mentioned an article from the *Zeitschrift des Vereines Deutscher Ingenieure*, by Prof. A. Riedler, on the Huber system of hydraulic pressure press, the high pressure to be applied equally on all sides of the work.

You say that this process is substantially the same as the one employed by the Gorham Manufacturing Company. Here I think you are mistaken, and I therefore wish to show you the difference between the two processes, as it may be of interest to you and your readers.

1. System of Gorham Manufacturing Company.—This system was shown at the Paris Exhibition and is not at all a new one, for the E. W. Bliss Company had tried it as far as I know some years ago, but abandoned it for various reasons. The principal point of this proces is to apply hydraulic pressure in combination with a punch that forces the water into a form

shaped like a shell, as outlined by the female die; thereby the female die must stand the whole hydraulic pressure, which amounts, according to the thickness and kind of material, to about 80,000 pounds per square inch and above. About 16,000 pounds may be sufficient for aluminum, thin brass and zinc. Therefore, you must make the female die strong enough to withstand this high pressure and even more—that is, if you are working on steel, a steel die a little stronger than it takes to make cold steel flow. There is no need of calling attention to the other difficulties of this process, such as how to close and open such heavy dies if made out of several parts, how to get a tight-fitting joint, etc.

2. The system of C. Huber dispenses with these difficulties. In this the high-pressure die is made once for all the following processes. It represents a simple cylinder of 6 to 14 inches diameter and 3 to 5 feet deep, strong enough to stand even 120,000 pounds per square inch. This is the only expensive part of the press, while all dies used in this cylinder need hardly be thicker than the material to be pressed or stamped, but have of course to be harder than the material they have to deal with. And now the difference: The dies of the Huber system have not to stand the high pressure as by a system where all the force is put on the die, but they are lying in the cylinder surrounded by equal pressure from all sides. The Huber die, as we may call it, consists of a thin steel plate bent and engraved, fit for the article to be pressed, and if all the air between die and shell is driven out the flowing metal fills the finest engravings, lines and letters just as well as it could be done by the electro-plating process. There is no danger of crushing the die, and no danger of crushing a ribbed or decorated glass if used as a female die and covered with a shell of brass or sheet steel. All ribs of the glass will be perfectly filled by the metal and the outlines of the brass cover are just the same as those of the original surface of the glass.

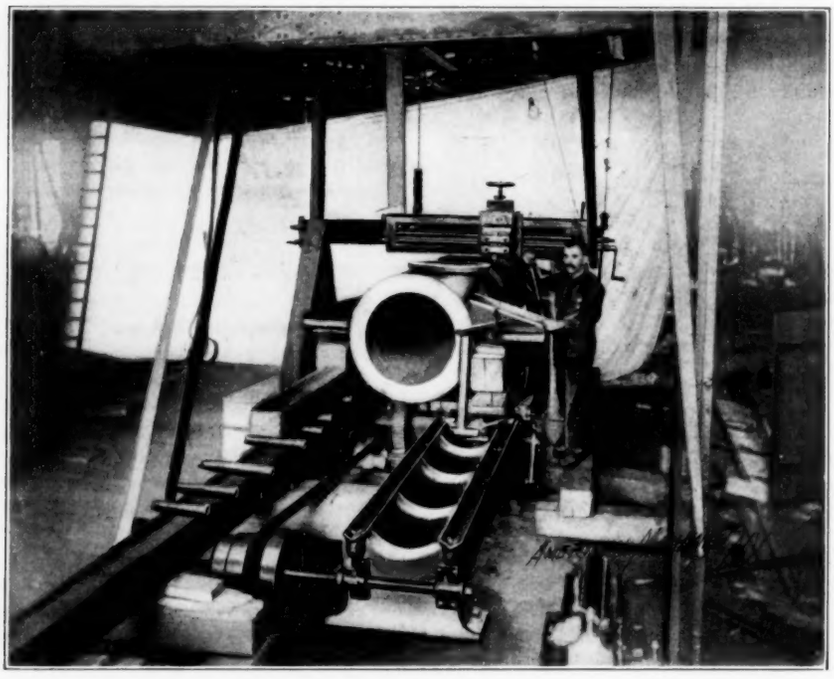


FIG. 1. PLANING A LARGE CYLINDER ON A SMALL PLANER.

The whole problem of the Huber process can hardly be shown more clearly than by this glass work. The pressure, from *all sides* alike, even though 80,000 pounds per square inch, brings the metal to the glass with equal pressure from inside and outside, the air between shell and glass gets the same pressure from the shell and from the glass, and this equilibrant condition is maintained during the whole process.

PASPRA.

Planing a Large Cylinder on a Planer—A Rack Extension.

Editor American Machinist:

The photographs will show without much explanation how we planed the valve seats on the ends of a cylinder 28 inches in diameter and 14 feet long. The planer, you will see, was very much too small. The cylinder had feet or wings on each side. One side only was supported on the planer platen. The farther side frame of the planer was removed, a longer cross rail was provided at the top and the outer end of it was firmly supported. A timber was placed parallel with the planer ways with strips of boiler plate on the upper side. Another timber to travel on this had boiler plate on its under side with rollers made of old boiler tubes between the two timbers. The outer feet of the cylinder were bolted to the upper timber. The man running the planer shipped the platen back and forth by hand. The third photograph shows a rack extension used for some extra long work we had to do.

Kenosha, Wis. A. G. CHILDREN.

Planer vs. Buzz-Saw.

Editor American Machinist:

The general public has long considered

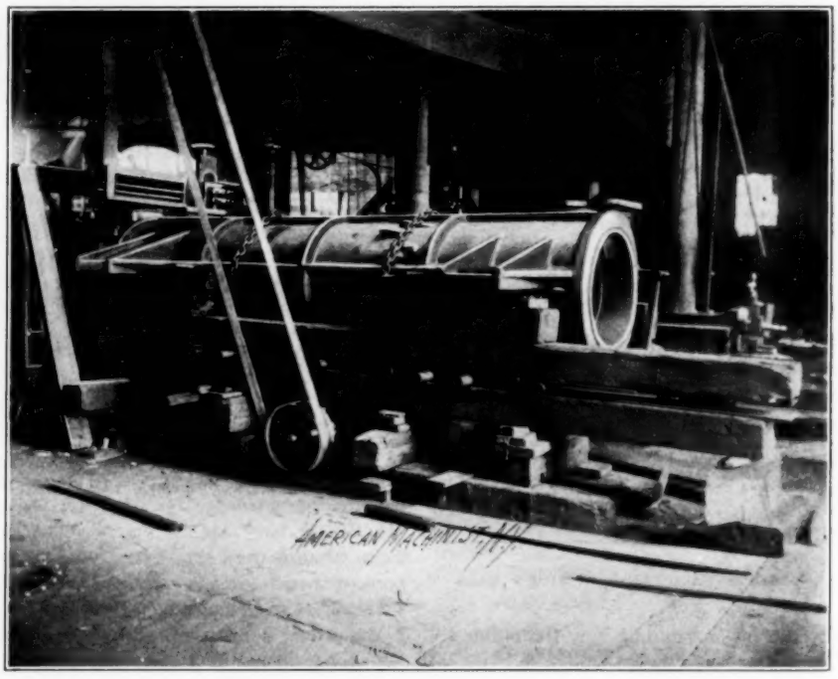


FIG. 2. PLANING A LARGE CYLINDER ON A SMALL PLANER.

the buzz-saw as the most dangerous implement mechanics have to deal with. Every wood-working establishment of any size has one or several buzz-saws, and I

suppose that this familiar menace has made wood workers oblivious to dangers existing in other machinery. Good machinery must be safe machinery, designed with an ample factor of safety, and the factor of "safety of the operative" should be foremost. Several wood workers have told me that one of the dangers they most feared and frequently experienced was from flying planer knives. I have not heard of accidents from this source, but from the construction of some woodworking machinery should think that such accidents were not unheard of. If this danger is as common as I am led to believe, and there is any planer on the market with securely held knives, the AMERICAN MACHINIST or some of its readers should let us know of it.

FERD. WERTHEIM.

[The danger from planer knives was once a familiar one to the wood worker, and deaths or serious accidents were frequent. From the fact that accidents of this character are now seldom heard of it is fair to assume that the cause has been mostly removed. Circular saw accidents are still all too familiar.—Ed.]

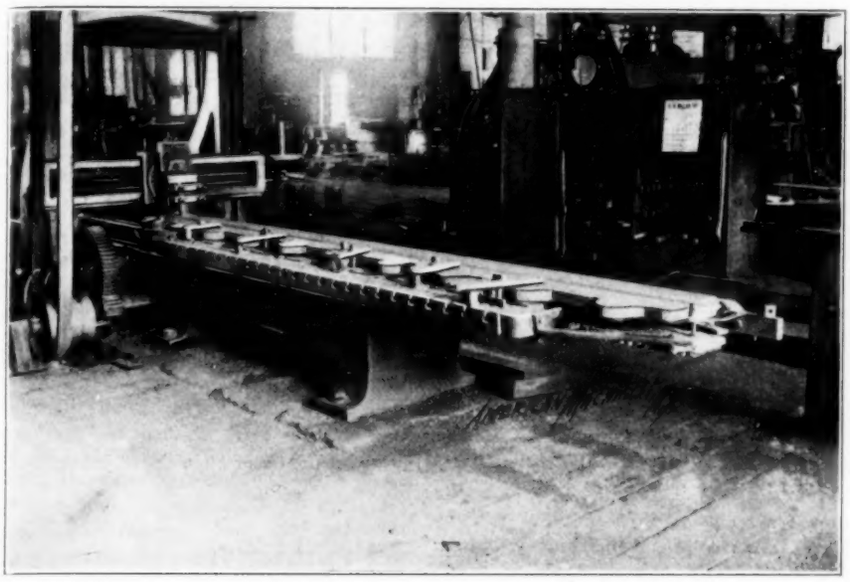


FIG. 3. A RACK EXTENSION FOR PLANER PLATEN.

Lathe Indicator.

Editor American Machinist:

The accompanying sketch represents a lathe indicator, which, though not entirely new, may interest some of the readers of the AMERICAN MACHINIST.

As the holder *a* is reversible, it can be used on quite a number of different sizes of lathes without any blocking up to bring the bar *b* to the right hight. The stud *c* may be turned at any angle found convenient. Two small half-round grooves on the top and bottom of the bar *b* admit of its being clamped by the small screw without injury. The end of the bar at *d* is hardened and all holes are carefully lapped out. The indicator point *e* which is also hardened, ground and lapped has an end movement of one-sixteenth of an inch, the small screw in the end of bar entering a depression in the center of indicator point and limiting its movement. By bringing the indicator point in contact with the work the error will multiply at the ratio of 30 to 1 at the extreme end of needle. The spring rod is used in connection with work which has been laid out with a center punch. S. B. M.

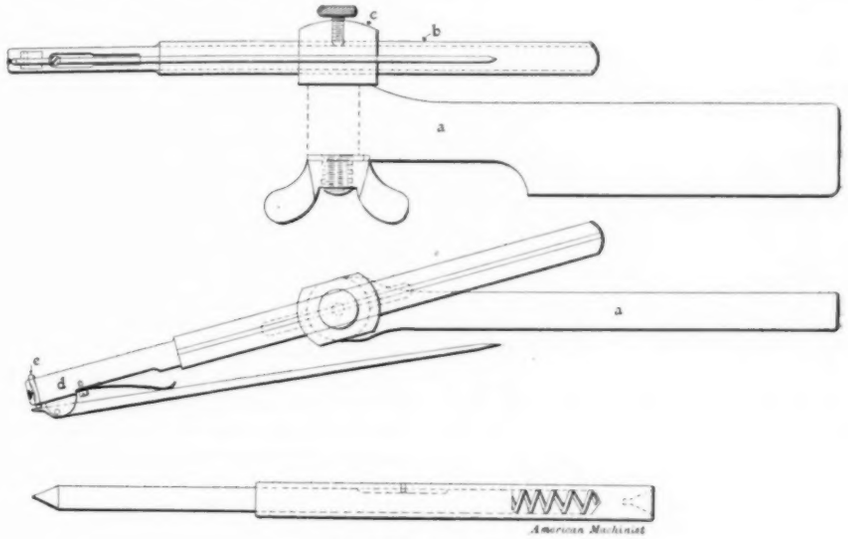
The Telescopic Screw for Universal Milling Machines.

Editor American Machinist:

We notice at page 422 that Messrs. Brown & Sharpe have brought out a new universal milling machine, and among the list of improvements mentioned as having been introduced is included "a telescopic screw arrangement for elevating the knee, so that it is no longer necessary to bore a hole through the floor for that screw."

It will perhaps be interesting for you to know that we brought out this arrangement for our universal milling machines about ten years ago, and have continued to put it since on all this class of machines.

WM. A. MUIR & CO., LTD.
L. A. MUIR, Manager.
Manchester, England.



LATHE INDICATOR.

Hard Soldering Troubles.

Editor American Machinist:

It sometimes happens in hard soldering that the expansion and contraction due to changes in temperature will cause considerable trouble when all conditions appear most favorable for a good result. I will mention a practical illustration in my experience.

A lamp shade holder was required to be built of brass with ⅛-inch pipe coupling for center; a cylindrical ring 8 inches diameter, of ⅜-inch tubing, cut open on top side for the shade (heavy glass) to rest upon, and three arms, also ⅜-inch tube butted against center coupling and joined to ring at three equidistant points. There was only one required and joints were all butted. These were fitted very nicely, the joint in the ring being soldered first; next the arms were soldered to the center piece, and finally an attempt was made to solder the arms to ring—and here the trouble started. We had a good, quick heat, the solder flowed very nicely, the joint appeared all sound and the work was laid aside to cool, with a feeling of satisfaction. Imagine our surprise at hearing a noise as of a joint breaking and finding on examination that this was the case. We made several attempts with the same result, until we finally opened the joint in the ring, soldered the arms and then soldered the joint in the ring. In this way we overcame all previous trouble.

These joints were soldered with silver

solder, and the greatest strain due to contraction on cooling evidently occurred when the existing temperature caused the solder to be comparatively weak. It is evident that a metal whose coefficient of expansion is lower would not produce so great a strain and might not rupture the joint. J. R. PRICE.

Philadelphia.

A Punching, Drawing and Forming Die.

Editor American Machinist:

I send a drawing of a set of combination tools and the shell the die makes. This die is at present in constant use in a small brass factory in Connecticut, and is doing its work at the rate of 12,000 to 15,000 pieces per day of nine hours.

I will first describe the shell and the reason for making it the shape shown in the sketch. The shell is the one used to make the ordinary one-piece electric-light shade holder in common use, and is made of sheet brass .020 inch thick and also out of the same gage of sheet steel brass plated.

The general outline of the shell will be readily understood by a glance at Fig. 6. *A* is the upper part of the shade holder, or rather the first formation of the upper part, and is drawn, as shown, to allow for parting at the center of the elongated part, in order to turn the two ends at right angles with *A*, through one of which a screw is passed and fitted to a tapped hole in the opposite side, and is supported by two lugs (not shown) that pass under a rounded flange, which is gained by piercing out the blank or beveled part of the shell, leaving the flange as part of the outer shell *B* and the lugs parts of the inner shell *A*. *A* is then formed up round to fit the brass sockets of an ordinary Edison, or any other make of electric light sockets.

The ears shown at *B*, Fig. 6, are drawn down at the same time into the shape shown, and are afterward pierced and a small projection is drawn out on them in order to get enough metal to tap for the small screws that hold the shade used on this style of holder.

Fig. 1 is a plan of the die, Fig. 2 a cross-section of the die through the center, Fig. 3 plan of punch or top section, Fig. 4 cross-section of punch, and Fig. 5 plan of cutting punch *B*, Fig. 4. The die proper is composed of five pieces, not counting the rubber spring and the parts that go with it, or the screws and pins. *A* is the cast-iron die bed, to which the cutting ring *E* is fitted, screwed and doweled (dowels not shown). *B* is the outer drawing ring fitted to the cutting ring *E* and sliding on the outside of inner ring or plug *C* which in turn slides on the outside of center drawing plug and piercing die *F* and *D*.

The ears *B*, shown in Fig. 6, of the shell are made by the half-round spaces cut out of the cutting ring *E*, Fig. 1, and are prevented from drawing out of shape by a channel cut out of drawing ring *B*, Figs. 1 and 2, as shown at *a b*. It will be noticed that the ring is cut out on both the upper and the inner edges. This is done to prevent the ears *B*, Fig. 6, from drawing out of shape and turning over when it is stripped from inner ring *C*, Fig. 2.

Inner and outer drawing rings *B* and *C*, Fig. 2, rest each on three pins (six in all) and these pins bear on the upper side of *A B*, which is held in place by a rubber spring *B C*, which in turn is held in place by a nut and washer (not shown) fitted to a piece of gas pipe large enough to allow the piercing from the center die *F* to drop through out of the way. The two rings *B* and *C*, Fig. 2, are always on the same plane until *C* comes to a stop on the flanged part of the center drawing plug and piercing die *F D*, and then *B* passes on down with the punch, Fig. 4, and draws the outer edge of the shell and the ears *B*, Fig. 6. This was made necessary in order to draw the upper part of shell *A*, Fig. 6; otherwise *B* would be too long and uneven around the edge and ears.

The punch, Figs. 3, 4 and 5, is made in six pieces, not counting screws and nuts. *A* is a cast-iron punch holder to which are fitted the cutting punch *B* and the threaded sleeve *F*, to which in turn is fitted the taper-shanked punch *B*, which pierces out the center of the shell, by coming in contact with center die *F D*, Fig. 2.

D is the drawing ring that forms the upper part of shell *A*, Fig. 6, and also prevents the metal from wrinkling up while the draw is being made. *D* is held in place by the three pins threaded into it. The punch *C* is located about ½ inch from the edge or face of cutting punch *B* to draw part of *A*, Fig. 6, before the center is pierced out; otherwise *A* would be too short and would be split around the edge, and the outer part of the shell would be too long. The adjustment of punch *C* is accomplished by turning the threaded sleeve *F*, Fig. 4, held in place by the taper shank of punch *C* and the nut *G*. The sleeve is held from turning by the set-screw *a c*, at the end of which is a copper plug fitted to threads of sleeve *F*.

The drawing of the upper part of shell *A*, Fig. 6, is done by the drawing ring *D* and the upper plate *E* on which a pin (passing through the knockout hole in gate of press) rests, on the upper end of which pin the knockout bar connecting with the back wall of the press rests, to which in turn is connected a rubber spring, fastened to the gate of the press. This keeps an even pressure between *D* of the punch, Fig. 4, and *C* of the die, Fig. 2, thereby preventing the metal from wrinkling, and at the same time drawing the upper part of shell A, Fig. 6, before the lower draw is made.

The outer punch *B*, Fig. 4, cuts out the blank for the shell, leaving the ears *B*, Fig. 6, on the outer edge of the blank, and engaging with the pressure ring *B*, Fig. 2, prevents the outer edge of the blank from crimping, and when the inner ring *C*, Fig. 2, comes to a stop at the bottom of the die, the punch *B*, Fig. 4, passes on down with the outer ring *B*, Fig. 2, and draws the lower part of shell *B*, Fig. 6, as shown. The edges of *C*, Fig. 2, and of *D*, Fig. 4, are left almost sharp, the edge being but slightly rounded; but the edges of *D*, Fig. 2, and of *B*, Fig. 4, must be rounded off to a good drawing edge, otherwise the die will not do its work satisfactorily.

Great care must be taken in building a die of this kind, as all working parts must be accurately made and located, the blanking and piercing punches must be an exact fit in the dies, and also in their respective holders, otherwise they will shift and shear off on the edge, and the edges of the shell will be uneven and split, especially on the edge of the upper part of the shell. The cutting ring and punch must be hardened and ground, and the pressure rings hardened and lapped to fit each other, otherwise

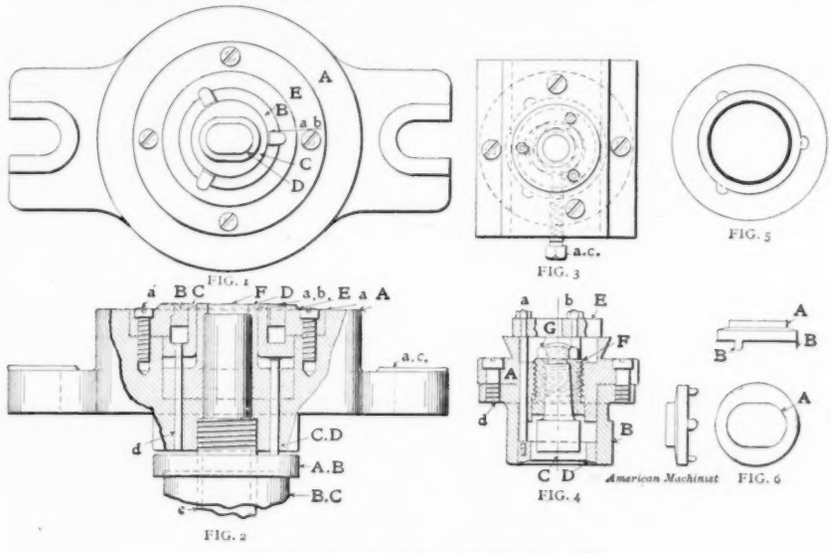


FIG. 1. FIG. 2. FIG. 3. FIG. 4. FIG. 5. FIG. 6.

A PUNCHING, DRAWING AND FORMING DIE.

the shell will be crimped around the edges and on the flat or beveled part between the upper and lower draws. The center piercing punch can be left soft in order to upset it when dull, but great care must be taken in order to keep it an even distance from the face of the outer punch; if not so, the shell will be uneven on the top of the upper part. *B* and *C*, Fig. 2, and *B* and *E*, Fig. 4, must be made a good running fit, and the pins must be free to slide up and down with the punch and pressure rings.

This die was made about four years ago, and is still in operation, taking the place of three sets of tools that we formerly used to make a shell almost the same, only not quite as hard a draw. W. W. P.

The Foundry Trade School.

Editor American Machinist:

I would like to take exception to some of Mr. Tecumseh Swift's sayings in his letter at page 669 regarding the foundry trade school.

Mr. Swift says: "And with unlimited time he and the young man might once in a while worry out an isolated casting that would pass inspection."

Once when visiting a certain well-known institution which bears a good reputation, but which for our purpose may remain nameless, I had one of the instructors in shop work inform me that he had never worked in a practical shop in his life. Mr. Swift's information must have been derived from school shops of this kind.

All school shops, however, do not deserve to be put in this class. I have in mind a certain school shop where there is much work done in the foundry that would put many practical molders to shame. At the same time the students are not "afraid to get their hands dirty," and, far from feeling that they are a little bit better than molders, as another of your correspondents seems to think, have a great deal of respect for them.

One job was carried through at this shop which outside foundries refused to touch unless they were paid for their loss from bad castings, the castings being of rather a delicate nature.

The school shop not only turned out all the castings that were required but had orders from outside parties for all they cared to make, and there was a comparatively small loss from bad castings.

It is nothing uncommon for this shop to get 80 per cent. of first-class castings from all molds poured during a heat—in fact, the percentage from most heats is far above this.

As a sample of the work done: A student was given a pattern and core box for a flanged elbow and told to make a mold for a "Y." He was to do it without any help or suggestions from the instructor, *and he did it.* The resulting casting was free from fins, and was such a good piece of work that several molders almost refused to believe it had been done as described.

As another example, the student was given a pulley pattern with loose arms and a rim about 4 inches wide, and required to make a casting of a pulley with a rim 6 inches wide, with the arms in the center. After this he would mold up a pulley with a 2-inch rim, using the same pattern. And, moreover, the above castings were first class in every particular. All of the castings at this school are made in cast iron and not in lead.

The above instances are merely samples of the regular work and not exceptional cases, as all the students are required to do work of this character, and as the boys are only in the shop for two hours at a time the molds in each case must be completed in that time. This of course is not quite as fast as an expert molder would be expected to do the work, but it is hardly "unlimited time."

In conclusion, the school mentioned above does not pretend to turn out molders, the foundry work being only one of many subjects in a general course. The entire foundry course, of which the above is a small part, only covers 120 hours' time, or about the same amount of time as two weeks spent in a regular shop.

If work of this character can be done incidentally in a school which does not pretend to make molders, and which devotes only about two weeks' time to it, it does seem as though a school such as Mr. West proposes, and giving the entire working day for several years, would prove eminently successful. I think Mr. Swift would agree with me in thinking that the work mentioned above is a little beyond the miniature lead flywheel stage.

JOHN L. BACON.

Lewis Institute, Chicago.

The Transformation of Want.

Editor American Machinist:

I won't tell anybody where it is, and your readers may find it for themselves just as I have, but I lately struck in your columns an expression which seems to fit. You speak, incidentally and apparently in entire unconsciousness of the wisdom of it, of a certain thing filling an "immediately recognized want." I couldn't help feeling at once how much better that way of saying it is than to speak of the filling of the "long felt want" that we have all heard so much about, but which so few of us have ever experienced. I wish while you were at it you could have put it in short words instead of in long ones. The best that I have been able to do with it is to get it down to a "quickly seen want," but it is not the same and not nearly as good.

It is a curious thing that we don't any of us know what we want, or at least all that we want, as men or as mechanics, much better than a baby knows its wants. The impulse to want anything with which we are not already familiar comes from external suggestion. The "long felt wants" at the time of their first filling could usually be better designated as newly made or newly revealed wants. It is not easy, perhaps, to be contented, but it is quite easy not to want any new thing. We must first know of the thing before we can want it, and if we avoid or shut out the knowledge, the want is not able to draw its first breath. So it is that ignorance can be most contented. We would progress very little and we would progress very slowly if we depended only on our first wanting things and on then finding the ways and means of supplying those wants.

We are educated and stimulated to want by having our wants supplied before we want. Investigators and imaginers, discoverers and inventors have much to answer for in this connection. They have not only been the ones who have brought us to most of our wants, they have not only got us into the habit of wanting, but they have got us into the more exacting habit of wanting to want, so that it is no longer respectable or comfortable not to want, and there is not the slightest prospect of our ever catching up with ourselves.

Still worse than the inventor class themselves are their agents, those who still further stimulate the wanting habit by disseminating the news of the means most recently obtained of supplying the wants hitherto undreamed of. When it comes down to this the work is divided up. The AMERICAN MACHINIST has taken hold of one end of the job, and see what trouble it has made! Not a manufactory, not an iron works, not even a poor little machine shop anywhere in the country has been left undisturbed in its old, comfortable and contented way of doing things. They have all had the want habit forced upon them, and the habit, like any other, grows by its exercise, and the more they get the more still they want. The best customers for the newest things are those who already have the new things.

The beauty of the modern and progressive and civilizing want arrangement is that you are not led to want the things that you can't have, but only to want the things that you can have, and which generally for business health you must have. It quite transforms the old ideas about wanting. The old want idea used to be associated mostly with nonfulfillment and disappointment, but there is nothing of that about the modern wants that we are compelled to acquire. The wants become demands, and the demands are in the habit of being met. The most successful in business are those who most fully accept the modern want idea. It is proper to want everything in sight, to want it with the modern idea of demanding and obtaining and of putting the thing acquired into service quickly. Those who only partially absorb the want idea, who are always on the defensive in their business habits, who

adopt the new methods and the new facilities only under protest and as a matter of business self-defence, are necessarily playing a losing game. It comes down after all to a choice of wants and not to a complete avoidance of them. If we don't catch on to the advanced style of wanting, demanding, getting, using the up-to-date things and ways and winning with them, we are likely to come to the genuine old-fashioned style of want, the kind of want that usually is not supplied. "To him that hath shall be given." There will be no gifts in these days, nor in the future as far as we can look into it, for the fellow that has not become a demander and appropriater of everything helpful already in sight in the line of his business. The real benefactors in these days are not those who supply and quench the old wants, but those who make new ones by providing in advance the means of satisfying them.

TECUMSEH SWIFT.

The Tool Equipment of French Locomotive Shops.

The idea has certainly never come to the mind of your readers to cast a glance at the "Official Journal of the French Republic"—that publication so badly printed, although so widely circulated in France, where almost every third citizen is an employee of the State.

However, the number of March 17, 1902 (pages 1988 to 2001) of the aforesaid journal contains information of a nature to interest builders of locomotives and machine tools in your country.

In fact, this number of the "Official Journal" reproduces several reports addressed to the Minister of Public Works by the President of the Commission of Rolling Stock of the Railways, on the one hand, and by the Director of Railways under the Minister of Public Works, on the other.

The Commission referred to was instituted May 4, 1901, with the object of studying the possibility of unifying rolling stock on the different French railway systems. The first report of the Commission, dated November 21, 1901, has recently been published. This Commission is presided over by M. Lax, former Director of Railways under the Minister of Public Works, and contains, among other members, the learned engineer, M. Henri Le Chatelier; MM. Mussat, Nadal, etc.

The Commission has heard the depositions of a great number of rolling stock manufacturers and metallurgists, as well as representatives of the principal railway companies of France. The majority of the representatives of metallurgical industries have pronounced for the unification of the types of locomotives, the simplification of tests and the suppression of some sorts of tests which appear to them useless. On the contrary, the constructors and engineers of the railway companies have pronounced in general against such unification. The constructors have insisted especially upon the necessity that there would be of placing orders of ten locomotives at least, in order to diminish the general expense of manufacturing these machines; but none of them has wished to avow frankly that the weak point of machine construction shops in France resides in the superannuated and defective tool equipment. Although, since the Exposition of 1900, under the influence of samples from America, there is noticeable a tendency to better the equipment, there remains much to do in pursuance of this idea.

It seems to us, in consequence, that machine tool builders of your country may greatly extend their field of action in France by putting the price of their machines within the reach of their clientele there.

In fact, there are still to be found in many celebrated French shops drills, for example, with a single tool where multiple drills could be employed with advantage; the turret lathe is not yet sufficiently appreciated in this country, and the milling machine might equally be employed with advantage, in many cases, to replace the planer, etc. If our memories do not deceive us, the French machine tool section of the Exposition of 1900 contained few modern machines of this sort. With regard to automatic machines for the manufacturing of quantities of similar articles, they are almost unknown with us. At the close of this letter will be found a characteristic anecdote illustrating this point.

But let us return to the report of which we intend to speak. The "Official Journal," unfortunately, does not give the depositions of different interests *in extenso*. However, a few resumés of these depositions suffice to show the remedy proposed by the deponents with a view to bettering the situation in rolling stock construction for the French railways.

There are in all, in our country, six companies with sufficient tool equipment for the construction of locomotives: viz., The Creusot (MM. Schneider & Cie.), The Compagnie Fives-Lille, The Société Franco-Belge, The Société de Construction de Batignolles, The Société Francaise de Constructions Mecaniques, and, finally, The Société Alsacienne de Constructions Mecaniques. (This last, the principal shops of which are in Alsace, constructs also machine tools that are quite celebrated.)

The deposition that seems to us most interesting is that of M. Louis Le Chatelier, president of the Council of Administration of the Société Francaise de Constructions Mecaniques (not to be confounded with his *quasi* namesake, M. Henri Le Chatelier, a member of the Commission). We cannot resist the pleasure of reproducing some of the most significant passages of the deposition of M. L. Le Chatelier (page 1995, second and third columns, of the "Official Journal," March 17, 1902).

According to this engineer, "the natural or economic causes which, beyond even the narrowness of the market, concur to render more onerous the French manufacture than that of America and Germany reside principally, on the one hand, in the greater dearness of raw materials, and on the other hand in the higher cost of labor, which is due to the higher rate of wages and smaller productivity of the French workmen.

"According to the deponent, in 1897 and 1898 raw materials cost in the United States 40 per cent. less than in France, and owing to this the price of locomotives there had descended to 80 or 85 centimes a kilogramme—that is to the price that we pay here for the raw materials.

"If, by reason of the fluctuations of the market, it has come to pass at times since then that the raw materials have attained in America prices comparable to those paid in France, the fact should be considered very exceptional.

"Wages in the United States are two to two and one-half times higher than in France, but the cost of hand labor involved in the same object manufactured there remains much below the cost here. This difference is due to the ***remarkable productivity of the American workman,*** to whom, with a great advantage to his efficiency, ***much initiative is allowed*** in his methods of making the best of an excellent tool equipment.

"If one passes now to Germany, it is found that raw materials there cost about 20 per cent. less than in France.

"The wages there are also higher. The productivity of the workman there is particularly favored, thanks to the ***remarkable qualities of the engineers of the German shops,*** qualities which enable them to bring the role of the workman to a par with that of wheel work running automatically under conditions of the most excellent efficiency."

To lessen the effect of these causes of our inferiority, it is expedient, according to M. Louis Le Chatelier, to have recourse to two sorts of measures.

"In the first place, it is necessary to ameliorate the supply and education of the technical personnel. The insufficiency of the number of existing professional schools and the inferiority of their instruction are in part the causes of the backwardness of our mechanical industry.

"In the second place, since, being under obligation to renounce export trade, the French builders cannot specialize in the construction of the locomotives, which would not furnish them a sufficiently large volume of business, they are deterred from equipping themselves exclusively for this sort of work, but are forced to construct, at the same time, other products. It is necessary, then, that they be able to machine their locomotives with the same tool outfit and the same personnel that they employ for the current mechanical work. But it is a fact that in France the building of this sort of engine

is an absolutely special line of mechanics, and it will be the same so long as present methods prevail. The large companies now insist, for example, upon employing unusual materials, such as iron not found in commerce and for the manufacture of which the builders must maintain a forge. They want wrought metal where cast steel would suffice. While they fail to study the parts of their machine with a care requisite to facilitate manufacture, they oblige their mechanics to create for the work a special tool equipment, costly, and not susceptible of secondary employment.

"It is desirable to lower, to an appreciable extent, the cost of production, without compromising in the least the quality of the machines, viz., by suppressing all superfluous work; by allowing, especially, to the builder a large tolerance in certain directions having relation to the service that ought to be rendered by such or such piece; by suppressing *the polish of all surfaces* that may without inconvenience remain in the crude state, the useless cementation of certain parts, etc."

We underscore especially the passage relative to polishing all surfaces. It is pre-eminently for want of this that American machines are reproached. We leave to the builders of your country to say whether this reproach is well founded.

But you are in a hurry to know the conclusion of all these laborious studies. It was once said that in France everything was finished with songs; in our day it might be said with much reason that everything is finished with commissions. In fact, the opinion at which the Minister of Public Works has arrived (he being a young advocate little smitten with traditions) upon the proposition of his Railway Director, is to prolong the authority of the Commission instituted May 4, 1901, and to entrust them with the examination of all questions attaching to orders for and manufacture of rolling stock of French railways.

We repeat that none of the deponents seems to us to have indicated the true cause of the inferiority of French locomotive builders relative to their competitors in other countries, and especially in America. It is not necessary to search for this cause elsewhere than in the repugnance which the French builders experience toward renewing their machine tools and their tool equipment in general.

We cite, in this connection, a typical incident. At the end of the Exposition of 1900 we received one day the telegram of one of our friends living in the provinces and holding the position of engineer in the shop of one of our large railway companies. He requested us to pilot him with one of his friends through the American pavilion at Vincennes. Having already paid numerous visits to that quarter, this request came to us agreeably. Faithful to an appointment, we proposed to the gentlemen to devote an afternoon to the visit, but one of them, not having much time at his disposal, wished also to visit the mechanical palace at Champs de Mars the same day. We directed our steps then toward the Vincennes pavilion in the hope of seeing all that there was interesting at the American exhibit in two or three hours. On the way I endeavored to put these gentlemen in a state of mind for the most remarkable things they were going to see by asking them a number of questions. It developed that my friend had never heard of automatic machinery, while his companion had indeed heard of it, but had never seen it in operation.

"But have you never read about it in the technical publications?" said I to my friend. "If your ignorance of the English language prevents you from subscribing for the AMERICAN MACHINIST, where are given the fullest descriptions of new American machine tools, you would have been able to find descriptions in the *Revue de Mecanique.*"

"What time have we to read the papers?" responded my friend.

Meanwhile, we approached the American pavilion. Having been there before, I said to the gentlemen, "There is a machine which will astonish you," and then described to them briefly the Pratt & Whitney automatic magazine screw machine equipped for finishing sewing machine hand-wheels. The traveling companion of my friend did not say anything, but the latter answered, smiling, "Say, now, my dear, it seems to me that you are making fun of us"—so incredible appeared to him what I had told them.

Arrived in the American pavilion, I conducted the gentlemen before the Pratt & Whitney Company booth, and when the obliging representative of this concern set in operation for us the machine in question my companions were reluctant to believe their eyes, and during almost an hour they did not cease to admire the operation of this machine. It goes without saying that our visit at the American pavilion prolonged itself until closing time, and that the visit to Champs de Mars was postponed until the following day.

I do not affirm that since then my friend has set himself to study English, nor even that he professes a more favorable opinion of the press; but what I particularly can say is, that he has taken note of several American machines in order to propose their acquisition by his engineer-in-chief.

Z.

Paris.

A German Acetylene Generator.

United States Consul General O. J. D. Hughes writes from Coburg that Mr. Erik Cornelius has invented a new acetylene generator, described as much simpler in construction than any yet placed upon the market, and occupying but little space. In its operation, the falling of the carbide into the water is automatically regulated by a hollow rubber ball, which, as soon as it is filled with gas, closes the valve between the carbide and the water. When the volume of gas decreases, the rubber ball contracts and the feed valve again permits the carbide to drop. The gas is stored partly in the rubber ball and partly in the space between the funnel-shaped carbide magazine and the water. If more than the normal amount of gas is generated, it secures more room by forcing the water through valves into the water jacket in the sides of the apparatus. A separate gas tank is therefore not needed. Should too much gas be produced, both the water and the gas escape through a safety valve. Common carbide is used; no cartridges. The gas is dried by being allowed to pass through the carbide magazine, where the carbide absorbs the moisture. As there is no gas tank, and as the quantity of gas thus stored is insignificant, it is considered that the fire insurance companies will, without raising the premiums, approve of the apparatus, even when it is placed in dwelling houses.

A British Triumph.

(One of our trade secrets has remained undiscovered by the Americans—viz., how to produce zylonite ping-pong balls absolutely round.—*English Daily Paper.*)

While the Yankees are stealing our trade by degrees
And are boasting of swamping us out as they please,
  It's a comfort to hear
  That in one little sphere
Our benighted old country is holding her own
By the help of a secret to others unknown.

They may capture our markets for iron and steel;
They may swallow our ships in a Morganite deal;
  They may show us how rotten
  Our lead is in cotton,
May send us their linen, their hemp and their shoes,
And their writing machines they may force us to use.

They may keep us in maize and may flood us with wheat;
They may beat our poor farmers with fruit or with meat;
  For, indeed, it's tremendous
  What treasures they send us,
And yet we have beaten them clean out of time
In a way I extol in this jubilant rhyme.

Let our principal industries totter and fall,
For the world is well lost for a celluloid ball,
  And our flag it shall wave
  O'er the free and the brave
Just as long as we guard as a secret profound
How it is we can turn table tennis balls round!

—*The London Graphic.*

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The Eight-Hour Bill.

The Eight-Hour Bill, which has aroused such strong contention between its advocates and opponents, has passed the House of Representatives without debate or division. Like the other bill elsewhere referred to, it may fail of being enacted, but if it passes it will probably have a very profound and far-reaching effect upon those industries that do business direct with the various departments of the government, and in fact it would seem that for a ship yard, for example, there would be only two practicable methods open. Either the entire establishment must be put upon an eight-hour basis, or separate and distinct departments must be organized and maintained for doing government work. In the former case the matter of wages would have to be adjusted, and that might not be easy. We do not understand, however, that the bill absolutely prohibits anyone from working more than eight hours on government work, but merely makes eight hours the standard working day, leaving the men and their employers free to agree upon terms for overtime work.

Naval Vessels from Navy Yards.

Those who have been advocating the construction in Government navy yards of a certain proportion of the new naval vessels have been successful, so far at least as the House of Representatives is concerned, that body having passed the bill advocated by labor union representatives requiring that one ship of each class shall be built at a Government yard. Of course this does not mean that the measure will certainly become a law, because it has yet to run the gauntlet of the Senate, and, while for reasons that are familiar few legislators care to put themselves on record as opposed to such a law, it is probable that many of them are opposed to it, and a convenient committee may easily find a convenient pigeon-hole for it, from which it may not emerge. Such is the end of many promising bills that are of such a character that few care to openly oppose them. Those who are opposing the bill, however, on the ground of its alleged paternal character would seem to be straining at a gnat, in view of the fact that the government already makes practically all of its small arms and most of its ordnance, and has also built some naval vessels, though not with very brilliant success, from a business standpoint. The labor representatives advocate the bill simply because workmen can obtain more favorable terms of employment in Government yards than in private ones—*i. e.*, shorter hours of labor, higher pay and less driving. There have been indications that some of the men in charge of navy-yard work have become more or less interested in the premium plan of paying for labor. If it could be adopted there, the men could make very high wages if they chose and the cost of vessels would not be so extravagant. Probably most of the men would object to its introduction but would be pleased with its working if wisely and fairly administered.

Our friend Arthur Bollinckx, of Brussels, Belgium, who is "L'Administrateur Delegue" of the corporation known as H. Bollinckx, writes us that he has considerable trouble from the fact that people who send him mail from America, catalogs, etc., do not generally seem to take pains to have the address right, and he sends us as specimens four envelopes received in one day by him from American houses, not one of which is correctly addressed, and some of which are addressed in an absurd manner—in a way, in fact, which would seem to make it very difficult to find the party addressed, and probably this could not be done were it not known by the postal authorities in Brussels that Mr. Bollinckx has numerous correspondents in America. Most of the letters are addressed "L'Administrateur Delegue, Brussels," which would be much the same as though one were to address an officer of a corporation here in New York as "President and Secretary, New York." Of course, this trouble arises from the fact that Mr. Bollinckx' requests for catalogs or for information are handed over to typewriters or office boys who know no French and who will not take pains to see that the address is intelligently inscribed, and it would seem as though, where it is worth while to send printed matter, or a letter, to Brussels at all, it ought to be worth while to take sufficient pains to see that the address is properly written.

In closing its series of articles on the premium plan *The Engineer*, of London, uses these words: "The premium system has in it, we believe, the element of the solution of the labor problems which most frequently confront the engineer; how far it may be extended into other industries we are unable to say. Certainly its possible ramifications in our own profession are very broad. We have thought of it almost solely in connection with the machine shop, but it is employed in almost every mechanical trade with similar success, and one of the claims for it put forward by its formulator is that it can be tempered to suit the easy work of the machinist, or the arduous labor of the smith. It is to a certain extent remarkable that although it was first given definite form in America, it has taken a better hold in this country, and particularly in Scotland, where the plan devised by Mr. Rowan is being widely adopted."

W. H. Anderson & Sons, of Detroit, send us a souvenir menu of a dinner which was given by the firm to a number of its employees in honor of the completion of a service of thirty years as foreman by Mr. Frank P. Christa. The occasion was evidently a very pleasant one, and among other things stated in the menu and pro-

gram we find the terms of service of a number of employees besides that of Mr. Christa, extending all the way from eight to twenty-two years. It is evident that the relations between this concern and its leading employees must be of a very pleasant character.

We have been invited to attend the International Navigation Congress, which is to be held at Dusseldorf from June 29 to July 5, in connection with the present exhibition going on there. This Congress is likely to be of exceptional interest and value to those who are interested in marine matters.

The office and sales department of the Sprague Electric Company had an outing a few days ago at New Dorp, Staten Island, the program including baseball and other games.

The Stepped Stocking Cutter.

Editor American Machinist:

In looking over to-day's issue of the AMERICAN MACHINIST we were considerably surprised to find in the editorial comment appended to the communication from Mr. Heinrich Meyer, that you say the stepped stocking cutter was submitted by us with a statement that it was "new."

While it is not our desire to promote any newspaper discussion, we feel that the manner in which you have placed the onus on us is unfair and not according to facts. The point under discussion is that we called this a new cutter; as mentioned in a previous communication to you, if you will look back over our correspondence, you will find that we never made such a statement or claimed that it was "new." In fact, we are aware that cutters similar to our stepped stocking cutter were used on the other side, the writer only recently having seen them at David Brown & Sons', Huddersfield, England, but not at the Reinecker Works. We also made a very similar form of stepped stocking cutter as far back as February, 1893, so knew better than to claim it as "new."

We combined the advantages of our previous form of stocking cutter with the cutter in question, and appreciating the merits such a cutter possessed we decided to put it on the market here, so that the American gear-cutting trade could obtain the benefits to be derived from using such cutters. We then offered it to you, as we thought it would be of interest to your American readers, as we knew it was not in general use in this country or cataloged either here or abroad.

In view of the fact that we did not say that they were new cutters, and the error of placing the article under the head of "New Things" was not ours, we feel it is due us that you publish this letter in the next issue of the AMERICAN MACHINIST so that we will be placed in the right light with your readers. GOULD & EBERHARDT.

Newark, N. J., May 15.

Examination for Assistant Examiner.

Referring to our note at page 739 regarding a Civil Service examination for assistant examiner in the Patent Office, to be held June 17-18, the Commission now announces an additional one for June 9-10, which appears to offer better opportunity for appointment soon. Those who have already applied for the later date may be examined on the earlier.

The Nine-Hour Day for Machinists.

The following is the summary of the Worcester strike situation at the close of last week:

The original strike on May 20 included four shops, Prentice Bros. Company losing 90 men, F. E. Reed Company 125 men, Marcus Mason 8 and H. C. Fish Company 9. One hundred and twenty-five men remained with the F. E. Reed Company and they claim to be gaining a half-dozen men per day. Prentice Bros. Company were the worst sufferers, a larger proportion of their men going out. This company has put out quite a lot of work among other manufacturers, and this action has stirred up the labor union considerably, and, to retaliate, union men have been ordered out in three other machine-tool shops or have been discharged for refusing to handle or work on Prentice Bros. machines. The shops above referred to are: Draper Machine Tool Works, 18 men out; Woodward Powell Planer Company, 17 men out, and Whitcomb Planer Company, 10 men out. It is reported that there is a strong possibility that the the union men in the shops of P. Blaisdell & Co. are likely to follow.

The molders' and core-makers' union has voted not to go out in sympathy with the machinists, and it is asserted that an old grudge is responsible for this, as during the last molders' strike the machinists refused to lend aid. The strike of the Worcester machine carpenters is in full blast and with no present signs of adjustment.

At Chicago the danger of any general strike of machinists this spring is believed to have passed away. Last week there were two or three sporadic strikes in shops of the city over the enforcement of the nine-hour day, but they were due more to the fact that the men themselves preferred a ten-hour day with Saturday half-holiday than to an indisposition of the manufacturers to grant the nine-hour d y straight. There are perhaps a dozen shops in Chicago where the ten-hour day still remains in effect, and representatives of the International Association of Machinists say the change in these will be made gradually.

The cigars from Mr. Thos. D. West—see page 739—came immediately to hand and are hereby acknowledged.

New Volumes in the American Society of Mechanical Engineers' Library.

The free Reference Library of Engineering, which is conducted by the American Society of Mechanical Engineers, at its house, 12 West Thirty-first street, New York city, has recently been favored by donation of the following books, from the authors of the volumes:

"Compound Engines"—James Tribe.
"Resistance and Propulsion of Ships"—W. F. Durand.
"Dynamometers"—J. J. Flather.
"Steam Boilers"—R. Wilson and J. J. Flather.
"Coal and Metal Miner's Pocket Book," "Mechanic's Pocket Memoranda," "Business Man's Pocket Book," "Building Trades Pocket Book"—Issued by the International Correspondence Schools.
"Elementary Electricity and Magnetism"—J. P. Jackson and D. C. Jackson.
"Press-Working of Metals"—Oberlin Smith.
"Kinematics of Machinery"—J. H. Barr.
"The Galvanometer"—E. L. Nichols.
"Electro-Magnetism and the Construction of Dynamos"—D. C. Jackson.
"Dynamo Electric Machinery"—Saml. Sheldon.
"Law of Contracts"—J. C. Wait.
"Compressed Air"—Frank Richards.
"Electrical Engineer's Pocket Book"—H. A. Foster.
"Boiler Practice"—W. B. Snow.
"Engine Tests"—G. H. Barrus.
"Easy Lessons in Mechanical Drawing and Machine Design"—J. G. A. Meyer.

Additions of the following volumes have also been made by purchase:

"Primary Batteries"—Henry S. Carhart.
"Dynamo Tender's Handbook"—F. B. Badt.
"The Telephone Handbook"—H. L. Webb.
"Alternating Currents and Alternating Current Machinery"—D. C. Jackson and J. P. Jackson.
"American Telephone Practice"—K. B. Miller.
"Das Eisenbahn Machinenwesen"—Blum, von Borries and Barkhausen.
"Horseless Vehicles"—G. D. Hiscox.
"Navigation"—Lucien Young.
"Liquid Air"—T. O'Connor Sloane.
"Screw Propellers"—I. McK. Chase.
"Rotary Transformers"—G. W. Colles.
"Water Power"—J. P. Frizell.
"Electric Power Transmission"—Louis Bell.
"Architectural Engineering"—J. K. Freytag.
"Testing Materials"—Martens.
"Roentgen Rays"—E. P. Thompson.
"Alternating Currents"—F. Bedell and A. C. Crehore.
"Localization of Faults in Electric Light Mains"—F. C. Raphael.
"Electrical Engineering for Students and Artisans"—W. Slingo and A. Brooker.

"Practical Management of Dynamos and Motors"—F. B. Crocker and S. S. Wheeler.
"Storage Battery"—Augustus Treadwell.
"Single and Multiple Currents"—Gisbert Kapp.
"Dynamo Electric Machines"—A. E. Wiener.
"History of Ready Reference," Vol. 6—J. C. Larned.
"Refrigeration"—Norman Selfe.
"Indicating the Refrigerating Machine"—Gardiner T. Voorhees.
"Steam Boilers"—G. Halliday.
"Heat"—Balfour Stewart.
"American Engineer in China"—W. B. Parsons.
"Civil Engineering" (1898)—W. J. M. Rankine.
"Carbuilder's Dictionary"—J. C. Wait.
"Eisenbahn Technik"—Von Borries.
"Mechanical Triumphs of the Ancient Egyptians"—T. M. Barber.
"Steam Boiler Economy"—W. Kent.
"Gas and Fuel Analysis"—A. Gill.
"Polyphase Electric Currents"—S. P. Thompson.

The library is open on all working days, between the hours of 10 A. M. and 10 P. M.

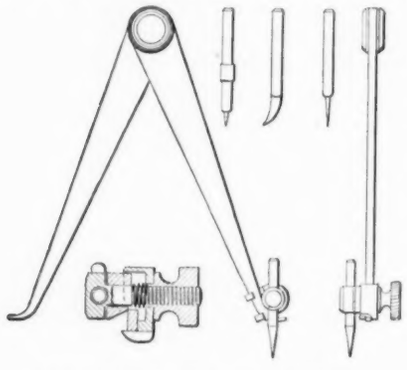
Some New Things.

DROP FORGINGS FOR SNAP GAGES.

J. H. Williams & Co., drop forgers, of Brooklyn, N. Y., have brought out a full line of drop forged snap gages. These are both single and double ended, some of them being with steps for limit gages and are of approved form, made of either mild steel which may be case-hardened or of tool steel to be hardened outright.

CHANGEABLE POINTS FOR CALIPERS.

The cut shows a handy little attachment for the familiar inside calipers of the machinist whereby the points of either or both legs are changed at will. The cut



CHANGEABLE POINTS FOR CALIPERS.

shows a needle point, a pencil lead holder and a reverse hook point, either of which may be slipped into the clamping device and at once be attached securely and in the desired position to the caliper leg. Tightening the knurled thumb nut tightens both the hooks which clasp the leg, and the holder for the point. The latter may of course be turned in any direction. The hooks will attach or can be made to attach to any of the familiar forms of caliper legs. This device is made by the Walker Tool Company, Milwaukee, Wis.

In Seattle, Wash., they have a lathe for turning masts and heavy spars. They are turned in a tank of water, which gets rid entirely of the weight-sustaining duty of the ordinary lathe. The water also serves as a sufficient lubricant for the centers.

In England they are circulating the story that we are unable to make ping-pong balls perfectly round. We have a hundred patents already on golf balls, and by the time that we have as many on the ping-pong balls they should not only be round but should have every other good quality.

Means have been taken to ascertain the amount of soot suspended in the atmosphere of Manchester, England. A ten-day deposit upon snow about three miles from the center of the city was weighed and analysed. It was equivalent in weight to 10.7 pounds per acre, or a little over 3 tons per square mile. Another sample taken near the center of the city figured up to nearly 1 ton per square mile per day. An analysis showed 48.6 per cent. carbon, 6.9 per cent. greasy matter and 44.5 per cent. ash.

The Schoeller Express Tool Steel.

We have received a leaflet describing the "Schoeller-Express" crucible tool steel, an Austrian product, for which the claims made are very strong. It is a steel which can withstand a high degree of heat, is easily forged and hardened, can be dressed cold without difficulty an is exceptionally tenacious. Numerous tests have shown that tools made of the "Express" can take a cut of 1¼ inches with a feed of ¼ inch and at a speed of over 175 feet a minute. The sellers therefore assert that on machines of the older and weaker construction the normal output can be more than doubled by using tools made of this steel, being limited only by the capacity of the machine, while on special machines constructed to withstand a heavy strain results have been achieved which surpass normal attainments three to five times.

A test of durability was made by turning a homogeneous iron shaft (tensile strength 49,780 pounds) from 12.8 inches down to 6.5 inches diameter. The test lasted 45 hours 11 minutes, the actual working time being 36 hours 27 minutes. The depth of the cut was ¾ inch; cutting speed, 21.335 feet a minute; weight of chips per hour, 73.106 pounds; total weight of chips, 3,461 pounds. The tool was not cooled or reground during the process. At the end of the test the edge was somewhat damaged, but still in a condition to be used. The turned surface of the shaft was clear and the chips colored between yellow and blue.

Another test was made with a steel shaft (tensile strength 71,120 pounds) which was turned from 12.6 down to 7.9 inches. The duration of test was 38 hours 40 minutes; actual working time, 34 hours 26 minutes; depth of cut, ¾ inch; cutting speed, 24.33 feet per minute; weight of chips per hour, 91.117 pounds; total weight of chips, 3,448 pounds. The cutting edge of the tool was in good condition at the end of the test and the turned surface perfect. The chips were colored a light yellow, and, as in the former case, the tool had not been reground or cooled.

It is asserted, moreover, that in the production of railroad axles, for which is used a material of about 71,000 pounds tensile strength, where other tools would last only three hours without being reground and hardened, those made of "Express" steel have lasted, without regrinding, 18 to 20 hours. We suppose, however, that the reference to the other steels with which a comparison is drawn does not cover the new steels of which we have previously given accounts.

The "Express" steel is made by the Ternitzer Stahl & Eisenwerke von Schoeller & Co., whose works are at Ternitz a. d. S., Austria. The agent for the United States and all American countries is the International Steel & Machinery Company, 245 Centre street, New York.

Technical Publications.

"The Arithmetic of Electrical Measurements." By W. R. P. Hobbs. 111 4¾x7-inch pages. D. Van Nostrand Company, New York. Price, 50 cents.

This book relates exclusively to calculations relating to the strength of currents, resistance of conductors, electro-motive force etc. The language is simple and clear and the book abounds with problems, the working of which should familiarize anyone with the subject.

"Armature Windings of Direct Current Dynamos." By E. Arnold. Translated from the German by F. B. DeGress. 124 6x9-inch pages, with 146 illustrations. D. Van Nostrand Company, New York. Price, $2.00.

This is a systematic treatise on armature windings and is based upon the author's formula which covers all closed coil windings and furnishes a general solution of the winding problem. The book should be of large importance to those engaged in the design of direct current generators and motors.

"Self-Propelled Vehicles." By J. E. Homans. 632 6x9-inch pages, with 466 illustrations. Theo. Audel & Co., New York. Price, $5.

This book is a descriptive treatise on present-day practice in the construction of automobiles. It is, however, much more than a collection of descriptions of various

makes of carriages, the various elements, boilers, burners, motors, frames; steering, driving and speed changing gears, bearings, brakes, etc., being compared and discussed in separate chapters. The book will be found of decided interest to all who are seriously interested in motor vehicles.

"Standard Polyphase Apparatus and Systems." Third edition. By M. A. Oudin. 289 5¼x7¾-inch pages, with 168 illustrations. D. Van Nostrand Company, New York. Price, $3.00.

This work received a favorable notice at our hands about eighteen months ago and the appearance of the third edition after so short an interval is proof enough that the notice was justified. The book is a strictly scientific explanation of the action of polyphase apparatus without any attempt at mathematical analysis, and it thus meets the needs of those who desire to understand how such apparatus works but who care nothing for the designer's mathematical knowledge of it.

"Logarithmic Tables of the Measures of Length, Extending from 0 to 50 Feet at Intervals of One-Sixteenth of an Inch." By T. W. Marshall. 106 3¼x5¾-inch pages. The Engineering News Publishing Company, New York. Price, $2.00.

These tables are intended to facilitate calculations in which dimensions are given as feet, inches and binary fractions, the logarithms of dimensions so expressed being given directly. The usefulness of the tables is shown in such calculations as the finding of the slopes of diagonal members of trusses of which the lengths, from workshop considerations, are given in binary fractions. The tables extend to seven figures and the logarithms are found directly without supplementary tables of differences or proportional parts. The mechanical execution is first class, the cover being of leather with rounded corners and of convenient size for the pocket.

"Hydraulic Motors and Turbines." Third edition. By G. R. Bodmer. 565 5x7¼-inch pages, with 194 illustrations. D. Van Nostrand Company, New York; Whittaker & Co., London. Price, $5.

The third edition of this standard treatise, when compared with the first edition, shows many additions, some of which, however, appeared in the second edition. Considerable space is given to the peculiarities of American wheels, including the Pelton, and a chapter is devoted to the Niagara Falls installation. The Venturi water meter and the important developments in governors which have resulted from the necessity for better regulation of electric generators than was possible by the old governors, receive due attention. The book is of English origin, and is an excellent example of what a technical treatise should be. The author is manifestly a master of his subject and his work is of corresponding value.

Personal.

Mr. David Rowan, of the firm of David Rowan & Co., marine engineers, of Glasgow, Scotland, is traveling in this country, this being his first visit to America. He is accompanied by his sister, Miss Rowan.

W. H. Booth, member of American Society of Civil Engineers, has left the service of Ludw. Loëwe & Co., Ltd., of London and Berlin, and has resumed his practice as steam engine, boiler and furnace expert, hydrogeologist, etc. Address pro tem, care 5 Warwick Court, Holborn, London, W. C., and 19 Chatsworth Road, West Norwood, S. E.

Obituary.

Leonidas C. Jewett, a well-known contributor to our columns on matters pertaining to the foundry, died at Taunton, Mass., sixty years old. Mr. Jewett was born in Kentucky, although on his mother's side he was a direct descendant of the Pilgrims. He had been in the foundry all his life and his wide experience and personal ability had made him an authority in this line and we found it convenient to refer to him questions on foundry practice, and his answers to them and his independent contributions found general approval and appreciation. Mr. Jewett had traveled extensively throughout North and South America and in Australia.

Captain George Cowie, a retired Chief Engineer of the United States Navy, was killed by being struck by a railroad train, May 22. He was slightly deaf as the result of gun concussions and did not hear the train. Captain Cowie was born in Scotland in 1846 and at the age of 18 he was appointed Acting Third Assistant Engineer from Iowa and saw active service at once, being in both of the battles at Fort Fisher. He became a Chief Engineer in 1892. He was on the "Indiana" at the destruction of Cervera's fleet and for his services on that occasion he was advanced three numbers. He was commissioned Lieut. Commander, and in 1899 Commander. In 1901 he was commissioned Captain and advanced three numbers on the retired list for "eminent and conspicuous conduct in battle."

Questions and Answers.

Name and address of writer must accompany every question. Questions must pertain to our specialties and be of general interest. We cannot undertake to answer by mail.

(9) A. G. K., Omaha, Neb., asks: Is it customary to add fresh acid to a pickling solution, and, if so, to what extent should it be carried? I have experimented some and find that after a short time it precipitates a large quantity of salts, which I suppose are sulphate of iron. When it reaches this stage I empty it out and start afresh. A.—It is customary to add acid a little at a time, and sometimes water also, as long as the pickle will work satisfactorily. There seems to be no more definite rule. Our correspondent might perhaps give us a more detailed narrative of his experience.

(10) J. T. G., Detroit, asks: Will you please tell me through the columns of the AMERICAN MACHINIST how to find the necessary pressure on hydraulic ram to flange a circular plate while hot; 14 inches diameter and ¼ inch thick; flange, when finished, 1¾ deep? A.—We referred this question to the Watson & Stillman Company, of New York, who build hydraulic machinery for such work. They reply: "Assuming that our interpretation of what is wanted is correct—that the desire is to make about a 10½-inch cup with 1¾-inch sides—we would give the probable pressure at about 150 tons doing it cold, and 25 tons hot."

Commercial Review.

NEW YORK, Monday, May 26.

THE IMPENDING FUEL FAMINE AND OTHER TRADE TOPICS.

Aside from the element of danger to business in general which exists in the coal strike situation and which applies to the machinery trade in common with other lines, the Eastern shops that have been burning anthracite have to meet the embarrassment of a shortage or a greatly increased cost of coal. Fuel is not of course the most important item in a machine shop bill of expenditures, but it amounts to something, and, coupled with the high price of castings already narrowing profits, it will increase the need of readjustment of values all around. Already we are told by the representative of one Eastern shop—a hydraulic machinery company in Massachusetts—that his company is looking very carefully into the coal question and that they intend to put in burners and go to using oil fuel if occasion requires, as the rising price of coal seems to indicate that it may require ere long. The correspondent raised the question whether a New England company might not find it advantageous to bring coal down from Cape Breton, a question which in view of the known cheapness of water freight as compared with land freights might be worth at least looking into. The fact that the bituminous mines in the United States are not yet tied up naturally relieves the fuel situation greatly, especially in the West. An official of a large manufacturing and engineering company in the Pittsburgh region tells us that the coal strike has not disturbed their business; in fact, since they are at present doing a large job of work in the anthracite region and owing to the supply of cheap labor there, the strike may inure to their advantage. Since bituminous coal is the mainstay for coke manufacture the anthracite strike does not imply an immediate deathblow to the foundry industry and consequently to the machine shops, whose dif-

ficulty in securing castings is at some points positively excruciating.

Since the above paragraph was put in type we learn that New England manufacturers are indeed taking thought of the Nova Scotian coal supply. It may be added that very grave anxiety as to the policy of the soft-coal miners exists in the iron and steel trade.

Wall Street men, it is stated, are pretty generally in apprehension of a crisis. The market is in a state of tension and may snap at any moment from a comparatively slight cause, as the failure of one firm or an event like the assassination of the Austrian Emperor, had the recent attempt on his life succeeded. Panics, it is pointed out, are wont to come like a thunderbolt from a clear sky. If that is so, there are perhaps enough gathering clouds of anticipation at present to avert the calamity.

There is certainly quite an advancing tendency in machine tool lines. One seller informs us that he knows of four or five cases in which increases have quite recently been made, one of them being on a line of pipe cutting and threading machines.

An advance in sheet steel which took place not long ago is reflected in the strengthening prices of a line of steel pulleys.

A machine tool builder from Worcester, Mass., who was in town Friday, deplored the effects of the strike upon the machine tool business at that place, which, he said, was so active that it could not well afford to be hindered in shop operations. He mentioned that castings were becoming dearer in that place, having already advanced in some cases. One foundryman who is letting his customers have more or less of the benefit of his stock of iron laid in at former prices, does not know where he can replenish the supply, when exhausted, at less than $6 a ton advance over the rate formerly paid. One of the most acute influences of the strike upon tool manufacture might be exerted through the medium of castings if there was a disposition among the foundry workers, who are strongly organized, to assist the machinists by refusing to let castings be furnished to shops where men are out on strike.

The machinists' supply trade in Philadelphia is flourishing, according to the observations of a local supply dealer who has just spent a few days in that city. While there he came in contact with different houses in his own line and found them all very busy. He did not observe that the labor situation was having any effect on trade.

Persons in touch with navy-yard affairs are naturally interested in the probability that the bill for construction of a warship by the government will go through and the question to what yard it will be awarded. If the proposition for the government to build three vessels had been sustained one of them would no doubt have been apportioned to the Pacific Coast and two to the Atlantic—say one at New York and one at Norfolk. With the number reduced to a single ship New York seems to stand the best show. As a result some new tools will naturally be required at the local navy yard, but the amount is not expected to be very large.

Requisitions for army and navy supplies are blossoming out with the spring roses. Many new advertisements have appeared within a few days past, among them being: Iron, steel, tools and files for Rock Island Arsenal; machine tools for Mare Island Navy Yard; band-saw machine for Norfolk (Va.) Navy Yard; pumping machinery for Fort Revere, Nantasket Head, Mass.; locomotive crane for League Island; machinery and tools for Boston Navy Yard; triple-power pump, motors, etc., for Portsmouth (N. H.) Navy Yard; tools, etc., for ordnance supplies at New York Arsenal.

There are reports, at present, of some pretty large machinery deals for foreign installations. One of these is the closing by the Westinghouse interests of contracts —amounting ultimately to $3,500,000—to convert a group of horse railways at Adelaide, South Australia, over to the electric system. M. Sergey Friede, of this city, is reported to have secured orders for $250,000 worth of equipment—largely machine tools—for the Chinese & Eastern Railway. The Ingersoll-Sergeant Drill Company is making substantial shipments of drills to the Transvaal mines.

The statement has obtained wide circulation in this country that the Deutsche Niles Werkzeugmaschinenfabrik's last annual report showed a loss of 1,000,000 marks—nearly $250,000. We have not noticed any contradiction of this statement. If true, it goes to illustrate the condition of the machine-tool trade in Germany that has long been a potent fact, and implies the obstacles with which those who are still working to sell American-built tools in that Empire have to compete. A short time ago things were looking a little brighter over there, but the improvement does not seem to amount to much at present.

The Fred. J. Swaine Company, St. Louis, Mo., manufacturer of presses, dies and sheet-metal machinery, informs us that owing to its constantly increasing business it has been compelled to find larger quarters and has purchased a site on the northeast corner of Seventh and O'Fallon streets, 111x125 feet, on which it will erect a modern factory more than double the size of its present one. The press department will be equipped throughout with traveling cranes, hoists, etc., and with several new tools, such as planers, boring mills and a number of other small tools. To the die department will be added several small special tools. The pattern-making department, also the drafting rooms, will remain practically the same with the exception that the space now occupied will be doubled. The blacksmith shop will be enlarged and equipped with all necessary tools. It also proposes adding about four ovens or furnaces for welding and hardening, the latter of which has become quite an item in its business. It has made every provision to have the lockers, wash-stands, etc., for its men equal to those of the best equipped shops in the country.

The Pittsburgh Blue Print Company has received orders aggregating to 50,000 yards of "Rapid Printing" blueprint paper during the month of May.

The United States Government is erecting a coaling station at Sangley Point, Manila, P. I., comprising a 418x75-foot wharf and two 194x300-foot coal sheds. Machinery has been designed to remove the coal from colliers by means of hoisting towers and distribute it in the storage sheds by automatic railways; also to coal the war vessels at the wharf from the shed. In doing this will be employed two steeple towers equipped with steam hoisting engines and duplex steam shovels, twelve automatic railways and over a mile of track. All this coal-handling machinery, together with accessories, such as railway equipment, cars, coal tubs, etc., is being built by the C. W. Hunt Company, New York. Recently thirty-six flat-top four-wheel cars were completed and shipped to the Philippin Islands. Each car is of one-ton capacity, to be used on the Hunt Industrial Railway.

The Treasury Department has decided that exported cast-iron pipe made from imported pig iron or scrap of imported pig iron is entitled to drawback, the basis on which it is to be granted being 105 pounds for ach 100 pounds of exported pipe.

The General Electric Company has made an offer to take over the Sprague Electric Company, and as a circular to that effect has been sent to the latter's stockholders it appears that the negotiations are of a substantial character.

The Crocker-Wheeler Company has filed plans of a new factory building at its works, Ampere, N. J. This will add 60,000 square feet to the floor space and will be used for the winding department, a part of the office force and additional machine-shop space. The company's orders for May show quite an increase over those in April.

The Lawrence Machine Company, of Lawrence, Mass. (New York offices, Taylor Building, 39-41 Cortlandt street) has received an order for a centrifugal pumping outfit capable of handling 6,500 gallons per minute, to be installed for dry-dock work at Kobe, Japan. The order came from Takata & Co., 10 Wall street, New York.

Wickes Bros., of Saginaw, Mich., builders of boilers, engines and a variety of other machinery, are making preparations to enter the New York market in a pretty

aggressive fashion. The firm has for some time had an office at 95 Liberty street, but this has been chiefly for the sale of boilers. They have recently built, however, and are at present fitting up, at West Bergen, in Jersey City, on the Newark branch of the Central Railroad of New Jersey, a brick structure, 400x100 feet, for use as a sales warehouse. Here they will carry machines of their own make and also second hand ones, such as engines, boilers, pumps, generators, blowers and iron-working machines. A representative of this paper visited the place the other day and found a number of large engines, etc., already on the floor. The firm intends to fit up in one end of the building a machine shop for overhauling the machines that come in. It already has the tools for installation there. A number of large engines for operating the Metropolitan Street Railway in New York by the cable system before it was transformed to electric traction were purchased by Wickes Bros. and have been resold. The firm's factory in Saginaw, Mich., represents an investment of some $500,000 or $600,000, about $200,000 worth of improvements having been completed within the last year. It contains among other tools a pit lathe capable of turning a pulley of 30 feet in diameter with 10 feet face, which they built for themselves. They have recently constructed twelve sets of grinding tables for the Saginaw Plate Glass Company. One of their important lines is saw-mill machinery, but this is adapted more especially for the Western trade. Pittsburgh has been one of their chief distributing points. A Pittsburgh paper lately contained a notice that they had bought land and were going to build a large shop there, but it is believed at this end of the line that the report is erroneous as to the new plant. They have good facilities at Saginaw, and it is argued the labor conditions of cities like Pittsburgh are not attractive. The scale on which the firm have built their warehouse in the New York district seems to us to make the event rather a noteworthy one in the engine market, especially if again in the future the matter of a stock ready for delivery is to cut the figure that it has done one or more times in the last few years.

President J. W. Duntley, of the Chicago Pneumatic Tool Company, has just returned from a trip through Europe. While there he secured orders for an aggregate of 2,700 Boyer and Little Giant pneumatic tools, as well as for twenty-five Franklin air compressors, for early delivery. Mr. Duntley states that the Europeans now realize the necessity of using labor-saving tools so as to reduce the cost of manufacture and counteract the influence of the "American invasion" and enable them to compete for the markets of the world. The opposition to pneumatic tools by workmen on account of their labor-saving qualities has been entirely overcome. The Chicago company's various plants are taxed to their utmost capacity and will have to be greatly enlarged in the near future.

The Cleveland Pneumatic Tool Company has appointed the Compressed Air Machinery Company, of San Francisco, Cal., to represent them on the Pacific coast.

CHICAGO MACHINERY MARKET.

The quieting down of the electrical machinery trade, noted a month ago, has disappeared. In its place is a return of what may be called high-water mark in the sale of machinery of this description. Reports are uniform that business is satisfactory. Some say it is because business long under negotiation has finally been closed; others that new inquiries are large factors to the current volume of orders.

The railroads are asking for considerable power. The Pennsylvania lines west of Pittsburgh have inquiries out for two 400 horse-power engines and generators with a complement of motors for the Fort Wayne shops and three outfits of about the same size for their Columbus shops. The Santa Fé road has been in the market for some time for considerable electrical machinery. The Rock Island road has asked for bids for the new passenger station in process of erection at Chicago. It will require 700 or 800 horse-power.

Manufacturing plants also are buying extensively. Nelson Morris is about to arrange for a central station plant at the stock yards requiring about 500 horse-power in generators and many motors. The St. Paul Foundry Company, St. Paul, has bought a complete electrical equipment consisting of 150 horse-power in generators and corresponding motors. The Charter Oak Stove and Range Company, St. Louis, is about to put in a 150 generator and many motors. The National Knitting Company, Milwaukee, has bought a complete electrical equipment for its plant, consisting of a 150 horse-power generator and motors to correspond. The Union Bag and Paper Company, Sandy Hill, N. Y., has made a large electrical addition, comprising 300 horse-power in engines and generator. The Great Northern Portland Cement Company, Detroit, Mich., will equip its whole plant electrically.

Foley & Williams have bought from the Northern Electrical Manufacturing Company a 150-kilowatt generator and about twelve motors for a new plant at Kankakee, Ill.

The Crocker-Wheeler Company has sold a 250-kilowatt generator to the Buda Foundry & Machine Company, Harvey, Ill.; twenty-four motors to the Gunthorp Warren Printing Company, Chicago, and fourteen motors to the Hornthal Company, Chicago.

The Sprague Electric Company has sold one 500 horse-power, one 150 horse-power and one 80 horse-power generator to the Emory, Bird, Thayer Dry Goods Company, Kansas City, making the largest isolated electrical plant in that city; one 400 horse-power generator and about 400 horse-power in motors to the Lehigh Portland Cement Company, for installation in the new plant at Wellston, Ohio; seventy motors, ranging from 15 to 125 horse-power each, to the Atlas Portland Cement Company, for installation at Hannibal, Mo., where three 550 Sprague engine-type generators were previously sold, making it the largest plant of the kind in the United States.

The H. W. Caldwell & Son Company, Chicago, has purchased the entire equipment of patterns, molding machines and tools for the manufacture of the Walker machine molded gears and power transmision machinery. The acquisition by the Westinghouse Electric & Manufacturing Company of the Walker plant in Cleveland, some years ago, is well known. The Walker Company's electrical business was the main thing from the standpoint of the Westinghouse Company, which states that the gear and transmission department is out of the line of its main business and that it has felt for some time it could not give this department such attention as the proper handling of the business would require. The Walker pattern list is said to be exceptionally complete. The H. W. Caldwell & Son Company proposes to do justice to the new line it has acquired. The company is at present maintaining an Eastern sales and engineering office in charge of R. T. Pearce, at 95 Liberty street, New York.

Quotations.

NEW YORK, Monday, May 26.

Pennsylvania Foundry Pig Iron, Jersey City delivery:

No. 1 X	$20 15 @ $20 65
No. 2 X	19 65 @ 20 15
No. 2 plain	19 15 @ 19 65
Gray forge	18 65 @ 19 15

Alabama Pig, New York delivery:

No. 1 foundry, or soft	20 25 @ 20 75
No. 2 foundry, or soft	19 75 @ 20 25
No. 3 foundry	19 25 @ 19 75
Foundry forge, or No. 4	18 25 @ 18 75

Bar Iron—Base sizes—Refined brands, mill price on dock, 1.93 @ 2.03c. in carload lots. Smaller quantities from store, 2.10 @ 2.25c.

Tool Steel—Base sizes—Good standard quality, 7c.; extra grades, 10c. and upward.

Machinery Steel—Base sizes—From store, 2.10 @ 2.25c.

Cold Rolled Steel Shafting—Base sizes—From store, 2¾c.

Copper—Lake ingot, 12⅝ @ 12¾c.; electrolytic, 12½ @ 12⅝c., casting, 12⅜ @ 12½c.

Pig Tin—In 5- and 10-ton lots, f. o. b., New York, 30½c.

Pig Lead—4.12½c. in 50-ton lots.

Spelter—New York delivery, about 4½ @ 4¾c.

Antimony—Cookson's, 10 @ 10¼c.; Hallett's, 8¼c.; U. S., 8 @ 8¼c.; various brands, 8c.

Lard Oil—Prime City, 80 @ 83c.

Manufacturers.

H. W. Hubbard, machinist, Keene, N. H., may build a new shop shortly.

George Chick & Son, Silver Lake, Me., are preparing to rebuild their lumber mill.

John Pearce & Son, Ottawa, Ill., have let the contract for building a box factory.

A new paper mill is to be erected by the Flambeau Paper Company, Park Falls, Wis.

A permit has been issued for a new building of the Lowell (Mass.) Hosiery Company.

Mr. Rufus K. Jordan, Portland, Me., is building a 24x50-foot addition to his foundry.

The Akron (N. Y.) Button Company has purchased a site on which to build its factory.

Work has begun on the 93x41-foot erecting shop of J. Oat & Sons, coppersmiths, Philadelphia, Pa.

The American Steel & Wire Company has begun work on a large new plant at San Francisco, Cal.

An addition, 53x138 feet, four stories, will be built at a plant of the American Can Company, Detroit, Mich.

The Utica Steam Cotton Mills Company has decided to erect another mill, 175x100 feet, at Utica, N. Y.

The American Can Company has opened bids for the erection of a new factory building at Baltimore, Md.

The Sodemann Heat & Power Company, St. Louis, Mo., will occupy a new building which is about to be erected.

The plant at Fulton, N. Y., of the Composite Board Company, New York city, has been destroyed by fire.

George E. Dickinson, Middlebury, Vt., is about to erect a machine shop. He will install modern machinery.

An addition will be built to the plant of the Parish & Bingham Company, sheet metal stamping, Cleveland, O.

C. D. White & Son's steam sawmill and lumber manufactory, Leeds, Me., have been burned, but will be rebuilt.

The National Casket Company is contemplating the erection of a new factory building for its Nashville (Tenn.) branch.

William H. Grundy & Co., manufacturers of worsted yarns, will build a 53x76-foot addition to their mill at Bristol, Pa.

The work on an addition to the works of the Sanitary Supply Company at New Castle Junction, Pa., is about beginning.

A Canadian Otis Elevator Company, a branch of the New York company, will build a factory at East Hamilton, Ont.

The Pittsburgh Reduction Company is to establish another large aluminum producing plant, this time at Massena, N. Y.

The Niagara Radiator Company, Buffalo, N. Y., is negotiating in regard to the location of a Western branch at Aurora, Ill.

The contract has been awarded for a new building to be erected by the New England Watch Company, Waterbury, Conn.

Plans have been filed for a two-story, 39x92-foot machine shop of the Quaker City Electric Company, Philadelphia, Pa.

Plans have been prepared for a new factory of the Westboro Weaving Company, manufacturer of narrow fabrics, Westboro, Mass.

The Standard Table Oil Cloth Company, 320 Broadway, New York city, proposes to establish a large plant at Rock Island, Ill.

The Continental Canning & Pickle Company will build at Norwalk, O., a plant which will include a 40x40-foot power-house.

Plans are being made for a factory addition for the Hayes Pump & Planter Company, of Galva, Ill. The improvement will cost $8,000.

The American Carving & Manufacturing Company, Grand Rapids, Mich., is having plans drawn for a three-story building, 104x60 feet.

The Norfolk (Va.) Knitting Mills will shortly increase their facilities by an annex, 40x52 feet, in which new machines will be installed.

The Republic Iron & Steel Company, Youngstown, O., will erect a structural iron and steel plant, which will employ 1,000 or more men.

The Lalance & Grosjean Manufacturing Company, stamped ware, New York city, is about to erect a factory building, 39x99 feet, at Woodhaven.

A permit has been granted the Western Electric Company to build a three-story factory at Polk and River streets, Chicago, Ill., to cost $86,000.

W. M. McKenzie and A. M. Dobbs, of Atlanta, and E. B. Ezell, Eatonton, Ga., have filed an application for charter to build an oil mill and guano factory at Eatonton.

There is talk of the New England Cotton Yarn Company, New Bedford, Mass., soon building a weave shed at the Bennett Mill plant to contain about 1,500 looms.

The Osborn Engineering Company, Cleveland, O., is preparing plans and specifications for the new $150,000 plant of the Cockshutt Plow Company, Limited, Brantfort, Ont.

The Diamond Match Company, Chicago, Ill., is about to erect a new building at its Barberton (O.) plant, which will increase the capacity of the factory there by 50 per cent.

Plans have been submitted to the Bureau of Building Inspection, Philadelphia, Pa., for a one-story addition, 164x74 feet, to one of the shops of J. G. Brill Company, car builders.

Ocker & Ford Manufacturing Company, Grand Rapids, Mich., manufacturers of sashes, doors, etc., are contemplating the erection of an addition to their factory this fall.

Smith, Drum & Co., machinery manufacturers, Philadelphia, Pa., contemplate the erection of a textile mill near their factory at Coral and Cumberland streets, it is reported.

The Star Pin Company, of Shelton, Conn., manufacturer of pins, hooks and eyes, has increased its capital stock from $40,000 to $200,000. The business of the concern will be enlarged.

The Wolcott Windmill Company, of Saginaw, Mich., will enlarge the scope of its establishment by the manufacture of gasoline pumping engines. A Chicago office will soon be established.

The men who have organized the Stamford (Conn.) Woolen Company intend to proceed at once with their building plans. The promotors are John W. Nary and Arthur Schwartz, of Syracuse, N. Y.

The O. S. Kelly Manufacturing Company will build a plant at South Milwaukee, Wis., for the manufacture of engines, threshers, separators and stackers. The plant will have a capital of $600,000 and will employ 600 hands.

The Stacey Manufacturing Company, manufacturer of gas and water tanks, Cincinnati, O., proposes to build a new plant soon. The first building will be 700x200 feet. After this will come another, 300x100 feet, and others.

At Topeka, Kan., a company is being organized to mine gold shale and use a process of Dr. Fahrig. It may be called the Fahrig Mining & Milling Company. H. P. Dillon, F. W. Freeman and Eugene Hagan are among those interested.

The plant of the Western Hardware & Manufacturing Company, Milwaukee, Wis., was partly destroyed by fire some time ago. The company is preparing to rebuild and is keeping at work in the old plant, which is without a roof.

The Bostwick Steel Lath Company, of Niles, O., has decided not to move its plant to Warren, but has bought an eight-acre site on the Erie Railroad, just west of Niles. The company will erect new buildings and increase its output.

The Lovering & Garrihughes Architectural Iron Works Company, of New York, has, it is reported, purchased a tract of land on the Lehigh Valley Railroad about a mile from Westfield, N. J., and will erect a plant to employ more than 150 men.

It is reported that William H. Cloher, Jr., representing some Utica (N. Y.) and out of town capitalists, will buy a knitting mill in New Hartford, N. Y. The plant will be equipped with new machinery. Electricity will be installed as a motive power.

A new plant is being built for the Beals & Selkirk Trunk Company, at Wyandotte, Mich. There will be a manufacturing building, 245x50 feet, three stories high; a box factory, 125x50 feet, three stories; a power-house, 26x90 feet, and a dry kiln, 25x40 feet.

M. C. Migel & Co., New York city (plant in Astoria) propose to establish at Baltimore, Md., a dress silk factory to employ about 400 hands. About $150,000 worth of machinery is to be installed. A temporary trial plant has been started there already, under the name, National Silk Company.

Excavations are about beginning for the main building of the Convertible Car Company at Bloomsbury, N. J. The structure will be 110x600 feet. Several other buildings will be erected later. It is expected that the plant will be in operation by January, 1903, and at least 250 men will be given employment at the start and the force eventually doubled.

The executive committee of the United States Radiator Company, Dunkirk, N. Y., has decided in favor of building a second plant, equal in size to the present one there, which is now yearly paying out $150,000 in wages, shipping 2,400 carloads of radiators, and melting 14,000 tons of iron. At present 267 men are employed.

Miscellaneous Wants.

Advertisements will be inserted under this head at 25 cents a line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Gear Wheels, gear cutting. Grant; see p. 18.

Punches & dies. Wal.M.Wks.,Waltham,Mass.

Caliper cat. free. E. G. Smith, Columbia, Pa.

Patterns and models. 19 Thames st., N. Y.

Ohio Township Officers Directory for 1902, now ready. R. S. Strader, Columbus, O.

Will buy or pay royalty for good patented machine or tool. Box 282, AMER. MACH.

Fine machine and experimental work. The Des Jardins Type Justifier Co., Hartford, Ct.

Light and fine mach'y to order; models and elec. work specialty. E. O. Chase, Newark, N. J.

Light machine & experimental work; models made. S. Messerer, 15 Springf. av., Newark,N.J.

F. J. Stokes Machine Co., 13th and Noble sts., Philadelphia, cut light gears, cams and duplicate small machine parts, in quantities.

Purchaser for complete sets of universal radial and plain upright drill patterns with drawings; for sale cheap. Address "Patterns," care AMERICAN MACHINIST.

Light and medium machinery built to order; estimates furnished on all kinds of machine work. F. J. Stokes Machine Co., 13th and Noble sts., Philadelphia, Pa.

Contract work wanted for small foundry and machine shop, used to doing good work

only; operated by owner, member A. S. M. E. Address Box 469, AMERICAN MACHINIST.

For Sale—One 24 in. semi-automatic turret lathe, built by American Turret Lathe Company; machine good as new; latest design. Curtis & Co. Mfg. Co., St. Louis, Mo.

Wanted—Small amount of capital, in a manufacturing business of great promise, protected by strong patents; shows fine returns on small investment. Address Box 533, A. M.

Small machine shop; a bargain; cost $1,200; new tools; engine (gas or gasoline), used only few months; chance of a lifetime; investigate. Address 38 W. Town st., Columbus, Ohio.

Purchaser for small manufacturing plant in Madison, Wis.; lot, 100x180 feet; machine shop, 32x68, two story, with line shaft and gasoline power; foundry, 40x54, new modern equipment; good location; for sale cheap. Hart-Parr Co., Charles City, Iowa.

Prof. Spangenberg's Practical Arithmetic for the Practical Mechanic; there are a great many mechanics who, through neglect or lack of opportunity, have forgotten what they knew about arithmetic; our new method requires no teacher; 194 pages; price 50 cents. G. A. Zeller, Pub., Room 590, 18 S. 4th st., St. Louis, Mo.

For Sale—Valuable real estate and machine shop in the city of Biddeford, Maine; the property known as the Hardy Machine Company, consisting of about thirty thousand (30,000) square feet of land, adjoining the track of the Boston & Maine R. R.; large three-story machine shop and foundry, with first-class machinery and tools for manufacturing the Hardy card grinder, and other machinery; the only general repair shop in this locality. For information apply to the President of the Company.

Wants.

Situation and Help Advertisements only inserted under this head. Rate 25 cents a line for each insertion. About six words make a line. No advertisements under two lines accepted, and no advertisements abbreviated. The cash and copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded. Applicants may specify names to which their replies are not to be forwarded; but replies will not be returned. If not forwarded they will be destroyed without notice. Original letters of recommendation or other papers of value should not be enclosed to unknown correspondents.

Situations Wanted.

An expert designing draftsman wants a hard job. "Pittsburg," care AMER. MACH.

Foreman patternmaker, experienced on molding machines, desires position. Box 508, AMERICAN MACHINIST.

Experienced mechanical and electrical draftsman, graduate, wants position. Box 516, AMERICAN MACHINIST.

Machinist, age 25, technical education, desires position as salesman. Address C. M., care AMERICAN MACHINIST.

Experienced mechanical draftsman wants position; vicinity New York preferred. Box 489, AMERICAN MACHINIST.

Experienced mechanical draftsman, educated in prominent technological institutes abroad, desires position. Box 518, AM. M.

Foreman desires position; toolroom or manufacturing department; wide experience, designing, construction; references. Box 535, AMERICAN MACHINIST.

Experienced man on automatic machinery; 10 years' experience, designer, superintendent, engineer; practical, educated; references. Box 505, AMERICAN MACHINIST.

Up-to-date foreman patternmaker wishes change after June 1; a wide experience in engine and large work and handling men. Box 537, AMERICAN MACHINIST.

Tool designer wants position; expert at designing tools, jigs, fixtures, etc., for reducing the cost of manufactured articles. Wm. H. Flood, 308 W. 123d st., New York City.

By man, 35, superintendent or master mechanic, or to take charge of an experiment requiring deep study; reference present concern. Box 517, AMERICAN MACHINIST.

Experienced machinery salesman, technical education, wishes to communicate with parties requiring the services of a competent representative. "Salesman," care AMER. MACH.

Designing draftsman, with long experience on electrical, engine and tool work, thoroughly posted on modern shop practice, wishes position with progressive firm. Box 528, A. M.

Technical graduate, 28 years old, experienced in shop, factory and general engineering work, with large manufacturing company, wishes change. Box 532, AMER. MACH.

Mechanical engineer with experience designing automatic and special machinery and tools for manufacturing purposes; reliable parties in Middle West preferred. Box 523, AMERICAN MACHINIST.

Mechanical engineer, graduate Stevens, several years' experience both mechanical and civil engineering, held important positions in Mexico, wants to change. Address Box 534, AMERICAN MACHINIST.

Energetic draftsman, European, 26 years old, tecanical graduate, desires change; experience in pumping machinery, Corliss, gas and oil engines; New York preferred. Box 522, AMERICAN MACHINIST.

Mechanical engineer with brains wants a chance to use them for some concern that will appreciate results; 43 years of age; good character; best references. Address "Results," care AMERICAN MACHINIST.

Draftsman; technical education; expert at designing jigs, tools, fixtures, etc., for reducing cost of manufactured articles; experience on machine tools, hydraulic press and experimental work. Box 526, AMER. MACHINIST.

Technical graduate, with practical experience in the design, manufacture and erection of heaters, condensers, cooling towers and street railway appliances, desires position as assistant superintendent. Box 529, AM. M.

Mechanic, energetic, resourceful, who has successfully handled large contracts, experienced in wide variety of work, seeks position with concern that wants to cut costs to lowest practicable limit. Address "Competent," care AMERICAN MACHINIST.

Designer, experienced in tools for interchangeable manufacture, special machinery and hopper feed work, desires position where man over 30, of inventiveness and energy, is wanted; highest references. Address "American," care AMERICAN MACHINIST.

Mechanical engineer desires correspondence with manufacturing company needing a man with extensive shop and drawing-room experience in design and manufacture of special, conveying and elevating machinery; graduate mechanical engineer; age 31; foreign experience erecting machinery. Address "Ahora," care AMERICAN MACHINIST.

Mechanical engineer desires position as superintendent of large manufacturing concern; age 43; has had 20 years' practical and successful experience on high-grade work; at present engaged with prominent company; executive and mechanical ability of the highest; thoroughly familiar with modern shop methods and rapid duplication of parts; excellent references. Address Box 519, AM. M.

Help Wanted.

Foreman, competent and energetic, for electrical machine shop. Box 494, AMER. MACH.

Wanted—A number of good patternmakers. Call or address De Laval Steam Turbine Co., Trenton, N. J.

Wanted—Two good, all-round patternmakers; state experience and wages. Columbus Iron Works Co., Columbus, Ga.

Wanted—All-round machinist; one used to gear cutting preferred. Boston Gear Works, 152 Purchase st., Boston, Mass.

Wanted—Several good patternmakers, by a machine tool manufacturing works in Jersey. Box 179, AMERICAN MACHINIST.

Machinists, send for blueprint table of U. S. S. steam, gas and water pipe, giving tapping sizes. Address E. E. Meyer, Allegheny, Pa.

Wanted—Good patternmaker on small engine and pump parts; large Western city; steady job; open shop; give references. Box 500, AMERICAN MACHINIST.

Wanted—Draftsmen; first-class designers with experience on small machines and jig and fixture work. Call on or address The Taft-Peirce Mfg. Co., Woonsocket, R. I.

Traveling salesman, East and West, in dies, presses and a full line of can-making machinery, special and sheet metal working machinery. Address Box 488, AMER. MACH.

Wanted—Experienced foreman for contract shop employing 60 hands on light machine work, located in Boston; young man will have the preference. Box 525, AM. MACH.

Foreman for planer department (15 tools), for machine shop in Western New York; lively and progressive man, successful in handling help. Address Box 520, AM. MACH.

Wanted—Mechanical draftsman in New York office; must be quick and accurate in laying out plain drawings; state age, experience, references and salary expected. Box 530, AMERICAN MACHINIST.

Wanted—For moderate sized shop in central California, a first-class draftsman designer for engine and general work; state age, experience, references and salary. Address Box 521, AMERICAN MACHINIST.

Wanted—Thoroughly competent foreman, to take charge of a switch and frog shop, as foreman; must have experience on steam and electric road work; give age, experience and references. Address C. S., care AMER. MACH.

Wanted—Outside man to sell factory supplies; one who has had some experience with laying out shafting and belting preferred; state age, experience, references and salary expected. Box 531, AMERICAN MACHINIST.

Wanted—Two or three first-class mechanical draftsmen to work on dredges, steam shovels, railroad wrecking cranes, etc. Apply, with statement of age, experience and references, to The Bucyrus Company, South Milwaukee, Wis.

Machinists wanted to act as shop agents and sell small tools where they work; send 44 cents for 6 in. tempered scale, No. 4, warranted; shall give a gold watch to some good agent. E. H. Randall, 235 Woodlawn ave., Springfield, Ohio.

We are enlarging our works, and will shortly require an increased number of skilled mechanics; we invite application from pattern makers, molders and machinists. Address the Westinghouse Machine Company, East Pittsburgh, Pa.

Wanted—A thoroughly experienced and trained chief draftsman familiar with Corliss and high speed engines and competent to take charge of the drafting room of an active, working establishment. Address XX, care AMERICAN MACHINIST.

Wanted—Thoroughly competent foreman on machine tool building, experienced in building pipe threading machinery, familiar with methods of producing duplicate parts on turret lathes; give age, experience, salary expected and references. Box 237, AMER. MACH.

Wanted—A young man as assistant foreman; must have a thorough knowledge of mechanics, machinery, tool making and modern factory methods; state present occupation, references and salary expected; a good opportunity for right man. Address Box 536, AMERICAN MACHINIST.

Wanted—First-class steam-fitter, thoroughly posted on high and low pressure work and general piping for manufacturing plant; must be sober and reliable, able to handle men, make sketches and lay out work; state age, pay expected and references. Address Box 514, AMERICAN MACHINIST.

Mechanical draftsman wanted, with shop experience, preferably in small wood and metal work; must have good designing judgment, accuracy and furnish best reference; good, permanent future for right man. Address, giving age, experience, salary and all particulars. Post Office Box 36, Philadelphia, Pa.

Wanted—As assistant to superintendent, bright, active man of 30 to 35, who has had practical experience in toolroom and modern methods of duplicate manufacture and shop systems; must be an organizer and of good executive ability; one having some technical training preferred; answer, giving full particulars. Box 538, AMERICAN MACHINIST.

Wanted—A good tool and die maker in a town of 60,000 in Southern Indiana; none but a practical, industrious and sober man need apply; steady work guaranteed the year round; write fully, stating experience and ability, age, whether married or single and lowest salary expected; name your reference in application. Box 527, AMER. MACHINIST.

Wanted—A young man to take charge of toolroom; must be a good designer of jigs and tools, able to handle a small number of men successfully and get work through rapidly and economically; a man having a knowledge of sheet metal working tools preferred; applicant should state age, previous experience, pay expected, etc. Address Box 524, AMERICAN MACHINIST.

Wanted.—A large Swiss firm, manufacturing all kinds of electrical engines, wants a first-rate foreman, capable of managing the whole factory; applicants are expected to possess a thorough knowledge of electrical branch, especially to be familiar with the construction of dynamos, and to have an extensive practical experience in the working of American machine tools; only men with long experience and great ability need apply; permanent position warranted if man engaged gives satisfaction. Address offers, stating age, experience, nationality, salary expected, recommendations, date of entrance, etc., to R. 2464 Q., care Haasenstein & Vogler, Basle, Switzerland.

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See Roller Bearings.

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Pond Mach. Tool Co., New York.
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See Grinding.

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Brown & Co., R. H., New Haven, Conn.
Cleveland Twist Drill Co., Cleveland, O.
Goodell-Pratt Co., Greenfield, Mass.
The E. Horton & Sons Co., Windsor Locks, Conn.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
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Trump Bros. Mach. Co., Wilmington, Del.
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Chucks, Lathe
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See Schools, Correspondence.

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Northern Engineering Works, Detroit, Mich.
North Penn. Iron Co., Phila., Pa.
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Sellers & Co., Wm., Philadel., Pa.
Whiting Foundry Equipment Co., Harvey, Ill.

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Dixon Crucible Co., Jos., Jersey City, N. J.

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Obermayer Co., S., Cincinnati, O.
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Rogers, John M., Boat, Gage & Drill Works, Gloucetser City, N. J.
Standard Tool Co., Cleveland, O.

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Veeder Mfg. Co., Hartford, Conn.

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Bliss Co., E. W., Brooklyn, N. Y.
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Barnes Co., W. F. & John, Rockford, Ill.
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Baush Mch. Tool Co., Springfield, Mass.
Bickford Drill & Tool Co., Cincinnati, O.
Bement, Miles & Co., New York.
Dallett & Co., Thos. H., Phila., Pa.
Niles Tool Works Co., New York.
Pond Mach. Tool Co., New York.

Drilling Machines, Pneumatic
Chicago Pneumatic Tool Co., Chicago, Ill.
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Phila. Pneumatic Tool Co., Philadelphia, Pa.

Drilling Machines, Multiple Spindle
Baker Bros., Toledo, O.
Barnes Co., B. F., Rockford, Ill.
Barnes Co., W. F. & John, Rockford, Ill.
Baush Mch. Tool Co., Springfield, Mass.
Bement, Miles & Co., New York.
Bickford Drill & Tool Co., Cincinnati, Ohio.
Dallett & Co., Thos. H., Phila., Pa.
Garvin Mach. Co., New York.
Harrington Son & Co., Edwin, Philadelphia, Pa.
Newton Machine Tool Works, Philadelphia, Pa.
Niles Tool Works Co., New York.

Drilling Machines, Portable
Dallett & Co., Thos. H., Phila., Pa.

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Aurora Tool Works, Aurora, Ind.
Amer. Tool Wks. Co., Cincin., O.
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Bement, Miles & Co., New York.
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Gang Co., Wm. E., Cincinnati, O.
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Pond Mach. Tool Co., New York.
Reade Mchry Co., Cleveland, O.

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Niles Tool Works Co., New York.
Quint, A. D., Hartford, Conn.

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Barnes Co., W. F. & John, Rockford, Ill.
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Slocomb & Co., J. T., Providence, R. I.

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Niles Tool Works Co., New York.

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See Grinding Wheels.

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Merritt & Co., Philadelphia, Pa.

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Charter Gas Engine Co., Sterling, Ill.
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Economy Engine Co., St. Joseph, Mich.
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Mietz, August, New York.
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Olds Motor Wks., Lansing, Mich.
Patterson, Gottfried & Hunter, Ltd., New York.
Regal Gasoline Engine Co., Coldwater, Mich.
Springfield Gas Eng. Co., Springfield, O.
Stover Engine Works, Freeport, Ill.
Struthers, Wells & Co., Warren, Pa.
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Buffalo Forge Co., Buffalo, N. Y.
Chandler & Taylor Co., Indianapolis, Ind.
Frick Co., Waynesboro, Pa.
Rand Drill Co., New York.
Struthers, Wells & Co., Warren, Pa.

Engine Stop
Consolidated Engine Stop Co., New York.

Exhaust Fans
Buffalo Forge Co., Buffalo, N. Y.

Exhaust Heads
Burt Mfg. Co., Akron, O.

Fans, Electric
Northern Elec. Mfg. Co., Madison, Wis.
Sprague Elec. Co., New York.
Westinghouse Elec. & Mfg. Co., Pittsburgh, Pa.

Files and Rasps
Barnett Co., G. & H., Phila., Pa.
Hammacher, Schlemmer & Co., New York.
Nicholson File Co., Prov., R. I.

Fillers, Oil Can
The Winkley Co., Hartford, Conn.

Filters, Oil
Burt Mfg. Co., Akron, O.

Fittings, Steam
Crane Co., Chicago, Ill.
Crosby Steam Gage & Valve Co., Boston, Mass.
Jenkins Bros., New York.
Lunkenheimer Co., Cincinnati, O.
Walworth Mfg. Co., Boston, Mass.

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Buffalo Forge Co., Buffalo, N. Y.
Miner & Peck Mfg. Co., New Haven, Conn.

Forgings Drop
Billings & Spencer Co., Hartford, Conn.
Miner & Peck Mfg. Co., New Haven, Conn.
Williams & Co., J. H., Brooklyn, N. Y.
Wyman & Gordon, Worcester, Mass.

Forgings, Hydraulic
Wyman & Gordon, Worcester, Mass.

Forgings, Steel
Wyman & Gordon, Worcester, Mass.

Foundry Furnishings
Obermayer Co., S., Cincinnati, O.
Whiting Foundry Equip. Co., Harvey, Ill.

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Am. Gas Furnace Co., N. Y. City.
Buffalo Forge Co., Buffalo, N. Y.
Chicago Flexible Shaft Co., Chicago, Ill.

Gages, Recording
Bristol Co., Waterbury, Conn.

Gages, Standard
Brown & Sharpe Mfg. Co., Providence, R. I.
Rogers, John M., Boat, Gage & Drill Works, Gloucester City, N. J.
Sawyer Tool Mfg. Co., Fitchburg, Mass.
Slocomb & Co., J. T., Prov., R. I.
Starrett Co., L. S., Athol, Mass.

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Bickford Drill & Tool Co., Cin., O.
Brown & Sharpe Mfg. Co., Providence, R. I.
Clough, R. M., Tolland, Conn.
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Fellows Gear Shaper Co., Springfield, Vt.
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Gould & Eberhardt, Newark, N. J.
Harrington & Son Co., Edwin, Philadelphia, Pa.
Newton Mch. Tool Wks., Phil., Pa.
Niles Tool Works Co., New York.
Whiton Machine Co., D. E., New London, Conn.

Gages, Steam
Crosby Steam Gage & Valve Co., Boston, Mass.

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Am. Gas Furnace Co., N. Y. City.

Gears, Cut
Bilgram, Hugo, Philadelphia, Pa.
Boston Gear Wks., Boston, Mass.
Cleveland Gear Wks., Cleveland, O.
Fawcus Mach. Co., Pittsburgh, Pa.
Fellows Gear Shaper Co., Springfield, Vt.
Gleason Tool Co., Rochester, N. Y.
Gould & Eberhardt, Newark, N. J.
Grant Gear Works, Boston, Mass.
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Nuttall Co., R. D., Pittsburgh, Pa.
Philadelphia Gear Works, Philadelphia, Pa.
Simonds Mfg. Co., Pittsburgh, Pa.
Van Dorn & Dutton Co., Cleveland, O.

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Franklin Mfg. Co., Syracuse, N. Y.
Greenwald Co., I. & E., Cincin., O.
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Chicago Raw Hide Co., Chicago, Ill.
Fawcus Mch. Co., Pittsburgh, Pa.
New Process Raw Hide Co., Syracuse, N. Y.
Nuttall Co., R. D., Pittsburgh, Pa.

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Leland & Faulconer Mfg. Co., Detroit, Mich.

Grinders, Cock
Windsor Mach. Co., Windsor, Vt.

Grinders, Disc
Besly & Co., Chas. H., Chicago, Ill.
Gorton Mach. Co., Geo., Racine, Wis.
Iroquois Mach. Co., Provi., R. I.

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Adams Co., Dubuque, Iowa.
Automatic Mach. Co., Greenfield, Mass.
Cincinnati Milling Mach. Co., Cincinnati, O.
Garvin Mach. Co., New York.
Gould & Eberhardt, Newark, N. J.
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Oesterlein Mach. Co., Cincin., O.
Pratt & Whitney Co., Hartford, Conn.
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Diamond Mach. Co., Prov., R. I.
Gisholt Mach. Co., Madison, Wis.
Iroquois Mach. Co., Provi., R. I.
Landis Tool Co., Waynesboro, Pa.
Leland & Faulconer Mfg. Co., Detroit, Mich.
Northampton Emery Wheel Co., Leeds, Mass.
Oesterlein Mach. Co., Cincin., O.
Safety Emery Wheel Co., Springfield, O.
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Besly & Co., Chas. H., Chicago, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Builders' Iron Foundry, Providence, R. I.
Diamond Mach. Co., Prov. ,R. I.
Goodell-Pratt Co., Greenfield, Mass.
Gorton Mach. Co., Geo., Racine, Wis.
Hill, Clarke & Co., Boston, Mass.
Iroquois Mach. Co., Provi., R. I.
Landis Tool Co., Waynesboro, Pa.
Northampton Emery Wheel Co., Leeds, Mass.
Northern Elec. Mfg. Co., Madison, Wis.
Norton Emery Wheel Co., Worcester, Mass.
Safety Emery Wheel Co., Springfield, Mass.
Washburn Shops, Worcester, Mass.
Webster & Perks Tool Co., Springfield, O.
Wilmarth & Morman Co., Grand Rapids, Mich.

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Northampton Emery Wheel Co., Leeds, Mass.
Norton Emery Wheel Co., Worcester, Mass.
Safety Emery Wheel Co., Springfield, O.

Grind Stones
Cleveland Stone Co., Cleveland, O.

Gun Barrel Machinery
Bement, Miles & Co., New York.
Diamond Mach. Co., Provi., R. I.
Niles Tool Works Co., New York.
Pond Mach. Tool Co., New York.
Reed Co., F. E., Worcester, Mass.

Hack Saw Blades and Frames
Diamond Saw & Stamping Wks., Buffalo, N. Y.
Goodell-Pratt Co., Greenfield, Mass.
Starrett Co., L. S., Athol, Mass.
West Haven Mfg. Co., New Haven, Conn.

Hack Saws, Power
Diamond Saw & Stamping Wks., Buffalo, N. Y.
Hoefer Mfg. Co., Freeport, Ill.

Hammers, Drop
Bement, Miles & Co., New York.
Billings & Spencer Co., Hartford, Conn.
Bliss Co., E. W., Brooklyn, N. Y.
Merrill Bros., Brooklyn, N. Y.
Miner & Peck Mfg. Co., New Haven, Conn.

Hammers, Pneumatic
Chicago Pneumatic Tool Co., Chicago, Ill.
Cleveland Pneumatic Tool Co., Cleveland, O.
Dallett & Co., Thos. H., Phila., Pa.
Phila. Pneu. Tool Co., Philadelphia, Pa.

Hammers, Steam
Bement, Miles & Co., New York.
Bethlehem Fdry. & Mach. Co., So. Bethlehem, Pa.
Cleveland Punch & Shear Wks. Co., Cleveland, O.
Pittsburgh Shear Knife & Mch. Co., Pittsburgh, Pa.

Handles, Machine Tool
Schacht Mfg. Co., Cincinnati, O.

Heating Machines, Automatic
Am. Gas Furnace Co., New York.

Heating and Ventilating Apparatus
Buffalo Forge Co., Buffalo, N. Y.

Hoists, Electric
C & C Electric Co., New York.
Hunt Co., C. W., West New Brighton, N. Y.
Northern Engineering Works, Detroit, Mich.
Pawling & Harnischfeger, Milwaukee, Wis.

Hoists, Hand
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Moyer & Co., J. W., Philadel., Pa.
Yale & Towne Mfg. Co., New York.

Hoists, Pneumatic
Chicago Pneumatic Tool Co., Chicago, Ill.
Cleveland Pneumatic Tool Co., Cleveland, O.
Northern Engineering Wks., Detroit, Mich.
Rand Drill Co., New York.

Hoisting and Conveying Machinery
Brown Hoisting Mchry. Co., New York.
Caldwell & Son Co., H. W., Chicago, Ill.
Hunt Co., C. W., West New Brighton, N. Y.
Link Belt Engineering Co., Philadelphia, Pa.
Moyer & Co., J. W., Philadel., Pa.
Niles-Bement-Pond Co., New York.

Indicators, Speed
Starrett Co., L. S., Athol, Mass.

Indicators, Steam
Crosby Steam Gage & Valve Co., Boston, Mass.

Inspection and Tests
Hunt Co., Robt. W., Chicago, Ill.

Injectors
Lunkenheimer Co., Cincinnati, O.
Sellers & Co., Wm., Phila., Pa.

Instruction Schools
See Schools, Correspondence.

Jacks, Hydraulic
Bethlehem Fdry. & Mch. Co., So. Bethlehem, Pa.
Watson-Stillman Co., New York.

Keys, Machine
Whitney Mfg. Co., Hartford, Ct.

Key Seaters
Baker Bros., Toledo, O.
Bement, Miles & Co., New York.
Chattanooga Mchy. Co., Chattanooga, Tenn.
Davis Mach. Co., W. P., Rochester, N. Y.
Mitts & Merrill, Saginaw, Mich.

Lamps, Arc
General Electric Co., N. Y. City.
Gen. Incan. Arc Light Co., N. Y. City.
Westinghouse Elec. & Mfg. Co., Pittsburgh, Pa.

Lathe Dogs
Armstrong Bros. Tool Co., Chicago, Ill.
Besly & Co., Chas. H., Chicago, Ill.
Le Count, Wm. G., So. Norwalk, Conn.
Pratt & Whitney Co., Hartford, Conn.

Lathes
American Tool Wks. Co., Cin., O.
Automatic Mach. Co., Greenfield, Mass.
Auto. Mach. Co., Bridgeport, Ct.
Barker & Chard Mach. T. Co., Cincinnati, O.
Barnes Co., B. F., Rockford, Ill.
Barnes Co., W. F., & John, Rockford, Ill.
Bement, Miles & Co., New York.
Bradford Mach. Tool Co., Cin., O.
Bullard Mach. Tool Co., Bridgeport, Conn.
Davis Mach. Co., W. P., Rochester, N. Y.
Diamond Machine Co., Provi., R. I.
Fay & Scott, Dexter, Me.
Flather & Co., Nashua, N. H.
Garvin Mach. Co., New York.
Grant Tool Co., Franklin, Pa.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Hendey Mach. Co., Torrington, Ct.
Hill, Clarke & Co., Boston, Mass.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
Lodge & Shipley Mch. Tool Co., Cincinnati, O.
McCabe, J. J., New York.
New Haven Mfg. Co., New Haven, Conn.
Niles Tool Works Co., New York.
Pond Mach. Tool Co., New York.
Pratt & Whitney Co., Hartford, Conn.
Reed Co., F. E., Worcester, Mass.
Schumacher & Boye, Cincinnati, O.
Sebastian Lathe Co., Cincin., O.
Seneca Falls Mfg. Co., Seneca Falls, N. Y.
Washburn Shops, Worcester, Mass.

Lathes, Automatic Screw-Threading
Automatic Machine Co., Bridgeport, Conn.

Lathes, Bench
Faneuil Watch Tool Co., Boston, Mass.
Waltham Watch Tool Co., Springfield, Mass.

Letters, Pattern
Butler, A. G., N. Y. City.
Racine Mchry. Co., Racine, Wis.

Levels
Starrett Co., L. S., Athol, Mass.

Lockers, Clothes
Merritt & Co., Philadelphia, Pa.

Locomotives, Shop
Hunt Co., C. W., West New Brighton, N. Y.

Lubricants
Besly & Co., Chas. H., Chicago, Ill.
Dixon Crucible Co., Jos., Jersey City, N. J.

Lubricators
Besly & Co., Chas. H., Chicago, Ill.
Bowen Mfg. Co., Auburn, N. Y.
Crane Co., Chicago, Ill.
Lunkenheimer Co., Cincinnati, O.

Machinery Builders, Special
American Fdry. & Mach. Co., Hanover, Pa.
Blanchard Mach. Co., The, Boston, Mass.
Pratt & Whitney Co., Hartford, Conn.
Simonds Mfg. Co., Pittsburgh, Pa.
Stowell, J. A., Leominster, Mass.

Machine Screws
Worcester Mach. Screw Co., Worcester, Mass.

Machinists' Small Tools
Besly & Co., Chas. H., Chicago, Ill.
Billings & Spencer Co., Hartford, Conn.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Twist Drill Co., Cleveland, O.
Hammacher, Schlemmer & Co., New York.
Patterson, Gottfried & Hunter, Ltd., New York.
Sawyer Tool Mfg. Co., Fitchburg, Mass.
Slocomb & Co., J. T., Provi., R. I.
Starrett Co., L. S., Athol, Mass.
Wyke & Co., J., East Boston, Mass.

Mandrels, Expanding
Nicholson & Son, W. H., Wilkesbarre, Pa.

Mandrels, Solid
Cleveland Twist Drill Co., Cleveland, O.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Rogers, John M., Boat, Gage & Drill Works, Gloucester City, N. J.
Standard Tool Co., Cleveland, O.

Measuring Machines
Rogers, John M., Boat, Gage & Drill Works, Gloucester City, N. J.

Micrometer Calipers
Brown & Sharpe Mfg. Co., Providence, R. I.
Sawyer Tool Mfg. Co., Fitchburg, Mass.
Slocomb & Co., J. T., Providence, R. I.
Starrett Co., L. S., Athol, Mass.

Milling Attachments
The Adams Co., Dubuque, Iowa.
Cincinnati Milling Mach. Co., Cincinnati, O.
Kempsmith Mfg. Co., Milwaukee, Wis.
Oesterlein Mach. Co., Cincin., O.

Milling Machines, Bench
Faneuil Watch Tool Co., Boston, Mass.
Waltham Watch Tool Co., Springfield, Mass.

Milling Machines, Portable
Underwood & Co., H. B., Philadelphia, Pa.

Milling Machines, Horizontal
Adams Co., Dubuque, Iowa.
Beaman & Smith Co., Provi., R. I.
Bement, Miles & Co., New York.
Franklin Mach. Wks., Phila., Pa.
Grant Tool Wks., Franklin, Pa.
Hendey Mach. Co., Torrington, Ct.
Ingersoll Mill. Mach. Co., Rockford, Ill.
Newton Mach. Tool Wks., Philadelphia, Pa.
Niles Tool Works Co., New York.
Pratt & Whitney Co., Hartford, Conn.

Milling Machines, Plain
American Tool Wks. Co., Cin., O.
Bement, Miles & Co., New York.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mach. Co., Cincinnati, O.
Garvin Mach. Co., New York.
Hendey Mach. Co., Torrington, Ct.
Hill, Clarke & Co., Boston, Mass.
Kempsmith Mfg. Co., Milwaukee, Wis.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
Oesterlein Mach. Co., Cincin., O.
Whitney Mfg. Co., Hartford, Ct.

Milling Machines, Universal
American Tool Wks. Co., Cin., O.
Bement, Miles & Co., New York.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mach. Co., Cincinnati, O.
Garvin Mach. Co., New York.
Hendey Mach. Co., Torrington, Ct.
Hill, Clarke & Co., Boston, Mass.
Kempsmith Mfg. Co., Milwaukee, Wis.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
Niles Tool Works Co., New York.
Oesterlein Mach. Co., Cincin., O.
Waltham Watch Tool Co., Springfield, Mass.

Milling Machines, Vertical
Bement, Miles & Co., New York.
Brown & Sharpe Mfg. Co., Providence, R. I.
Garvin Mach. Co., New York.
Ingersoll Mill. Mach. Co., Rockford, Ill.
Newton Mach. Tool Wks., Philadelphia, Pa.
Niles Tool Works Co., New York.
Pratt & Whitney Co., Hartford, Conn.

Milling Tools, Adjustable
Geometric Drill Co., Westville, Ct.
Rogers, Boat, Gage & Drill Wks., John M., Gloucester City, N. J.

Molding Machines
The Adams Co., Dubuque, Iowa.
Tabor Mfg. Co., Philadelphia, Pa.
Webster & Perks Tool Co., Springfield, O.

Molds, Hammer and Vise Jaw
Field, Chas. H., Providence, R. I.

Motors, Electric
Akron Elec. Mfg. Co., Akron, O.
C & C Electric Co., New York.
Commercial Electric Co., Indianapolis, Ind.
Crocker-Wheeler Co., Ampere, N. J.
Eck Dynamo & Motor Works, Belleville, N. J.
General Electric Co., New York.
General Incan. Arc Light Co., New York.
Jantz & Leist Elec. Co., Cin., O.
Northern Elec. Mfg. Co., Madison, Wis.
Robbins & Myers Co., Springfield, Ohio.
Roth Bros. & Co., Chicago, Ill.
Sprague Electric Co., New York.
Triumph Elec. Co., Cincinnati, O.
Westinghouse Elec. & Mfg. Co., Pittsburgh, Pa.

Name Plates
Franklin Mfg. Co., Syracuse, N. Y.

Nut Tappers
See Bolt and Nut Machinery.

Oil Cups and Covers
Bay State Stamping Co., Worcester, Mass.
Besly & Co., Chas. H., Chicago, Ill.
Bowen Mfg. Co., Auburn, N. Y.
Crane Co., Chicago, Ill.
Lunkenheimer Co., Cincinnati, O.
The Winkley Co., Hartford, Conn.

Oils
Besly & Co., Chas. H., Chicago, Ill.
Houghton & Co., E. F., Philadelphia, Pa.

Packing, Metallic
U. S. Metallic Packing Co., Philadelphia, Pa.

Packing, Steam Joint
Jenkins Bros., New York.

Pans and Tote Boxes
Kilbourne & Jacobs Mfg. Co., Columbus, O.

Patents
Baldwin, Davidson & Wight, Washington, D. C.
Cromwell, W. H., Washington, D. C.
Cullen, Orlan Clyde, Washington, D. C.
Frothingham, N. L., New York.
Stevens & Co., Milo B., Washington, D. C.

Pattern Shop Machinery
American Machinery Co., Grand Rapids, Mich.
Baker Bros., Toledo, O.
Fay & Scott, Dexter, Me.
Field, Chas. H., Providence, R. I.

Patterns, Wood
Balkwill Pattern Works, Cleveland, Ohio.
Gobeille Pattern Co., Cleveland, O.
Lorentz & Evarts, Hartford, Conn.
Topping, J. R., Hartford, Conn.

Pipe and Fittings
Crane Co., Chicago, Ill.

Pipe Cutting and Threading Machines
Curtis & Curtis Co., Bridgeport, Conn.
Merrell Mfg. Co., Toledo, O.
Oster Mfg. Co., Cleveland, O.
Saunders' Sons, D., Yonkers, N. Y.
Wells Bros. Co., Greenfield, Mass.

Pipe Fitters' Tools
Cleveland Twist Drill Co., Cleveland, O.
Saunders' Sons, D., Yonkers, N. Y.
Standard Tool Co., Cleveland, O.

Planer, Jack
Armstrong Bros. Tool Co., Chicago, Ill.

Planers
Amer. Tool Wks. Co., Cincin., O.
Bartlett, E. E., Boston, Mass.
Belmer Mach. Tool Co., Cin., O.
Bement, Miles & Co., New York.
Betts Mach. Co., Wilmington, Del.
Cincinnati Planer Co., Cincin., O.
Detrick & Harvey Mch. Co., Baltimore, Md.
Flather Planer Co., Mark, Nashua, N. H.
Garvin Mach. Co., New York.
Gray Co., G. A., Cincinnati, O.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Hendey Mach. Co., Torrington, Ct.
Hill, Clarke & Co., Boston, Mass.
Niles Tool Works Co., New York.
New Haven Mfg. Co., New Haven, Conn.

Planers—*Continued*
Pond Mach. Tool Co., New York.
Sellers & Co., Wm., Phila., Pa.
Whitcomb Mfg. Co., Worcester, Mass.
Woodward & Powell Planer Co., Worcester, Mass.

Planers, Rotary
Bement, Miles & Co., New York.
Cleveland Punch & Shear Works, Cleveland, O.
Franklin Mach. Wks., Phila., Pa.
Newton Mch. Tool Works, Philadelphia, Pa.
Pond Mach. Tool Co., New York.

Presses, Hydraulic
Bement, Miles & Co., New York.
Watson-Stillman Co., New York.

Presses, Power
Automatic Mach. Co., Bridgeport, Conn.
Bethlehem Fdry. & Mch. Co., So. Bethlehem, Pa.
Bliss Co., E. W., Brooklyn, N. Y.
Mossberg & Granville Mfg. Co., Providence, R. I.
Torris, Wold & Co., Chicago, Ill.

Profilers
Garvin Mach. Co., New York.
Pratt & Whitney Co., Hartford, Conn.

Pulley Turning and Boring Machines
Harrington, Son & Co., Edwin, Philadelphia, Pa.
New Haven Mfg. Co., New Haven, Conn.
Niles Tool Works Co., New York.

Pulleys
American Pulley Co., Philadelphia, Pa.
Cresson Co., Geo. V., Philadel., Pa.
Howard Iron Wks., Buffalo, N. Y.
Jones Fdry. & Mch. Co., W. A., Chicago, Ill.
Poole & Son Co., Robt., Baltimore, Md.
Reeves Pulley Co., Columbus, Ind.

Pulleys, Friction Cone
Evans Friction Cone Co., Boston, Mass.

Pumps, Hydraulic
Elmes Engineering Works, Chas. F., Chicago, Ill.
Watson-Stillman Co., New York.

Punches, Hydraulic
Bement, Miles & Co., New York.
Bethlehem Fdry. & Mch. Co., So. Bethlehem, Pa.
Watson-Stillman Co., New York.

Punches, Power
Bliss Co., E. W., Brooklyn, N. Y.
Bremer Mach. & Tool Co., Kalamazoo, Mich.
Buffalo Forge Co., Buffalo, N. Y.
Cleveland Punch & Shear Wks., Cleveland, O.
Hilles & Jones Co., Wilmington, Del.
Long & Allstatter Co., Hamilton, Ohio.
Pittsburgh Shear Knife & Mach. Co., Pittsburgh, Pa.
Reade Mchry. Co., Cleveland, O.

Rack Cutting Machines
Fellows Gear Shaper Co., Springfield, Vt.
Gould & Eberhardt, Newark, N. J.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
Reed Co., F. E., Worcester, Mass.

Racks, Cut
Fellows Gear Shaper Co., Springfield, Vt.
Nuttall Co., R. D., Pittsburgh, Pa.
Simonds Mfg. Co., Pittsburgh, Pa.
Van Dorn & Dutton Co., Cleve., O.

Reamers
Cleveland Twist Drill Co., Cleveland, O.
Clough, R. M., Tolland, Conn.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt & Whitney Co., Hartford, Conn.
Rogers, John M., Boat, Gage & Drill Works, Gloucester City, N. J.
Standard Tool Co., Cleveland, O.
Wells Bros. Co., Greenfield, Mass.

Reaming Stands
Flather Planer Co., Mark, Nashua, N. H.

Rheostats
General Incan. Arc Light Co., New York.

Riveters, Hydraulic
Bement, Miles & Co., New York.
Watson-Stillman Co., New York.

Riveters, Pneumatic
Bement, Miles & Co., New York.
Cleveland Pneumatic Tool Co., Cleveland, O.
Philadelphia Pneumatic Tool Co., Philadelphia, Pa.

Riveting Machines
Bement, Miles & Co., New York.
Bethlehem Foundry & Mach. Co., So. Bethlehem, Pa.
Long & Allstatter Co., Hamilton, Ohio.

Rods and Straps, Connecting.
Standard Connecting Rod Co., Beaver Falls, Pa.

Roller and Ball Bearings
Ball Bearing Co., Philadel., Pa.
Mossberg & Granville Mfg. Co., Providence, R. I.
Roller Bearing & Equipment Co., Keene, N. H.

Rolling Mill Machinery
Cleveland Punch & Shear Wks. Co., Cleveland, O.
Diamond Drill & Mch. Co., Birdsboro, Pa.
Hilles & Jones Co., Wilmington, Del.
Mossberg & Granville Mfg. Co., Providence, R. I.
Pratt & Whitney Co., Hartford, Conn.

Safety Valves Pop
Crane Co., Chicago, Ill.
Crosby Steam Gage & Valve Co., Boston, Mass.
Lunkenheimer Co., Cincinnati, O.

Sawing Machines, Metal
Cleveland Punch & Shear Works Co., Cleveland, O.
Newton Mach. Tool Works, Philadelphia, Pa.
Pratt & Whitney Co., Hartford, Conn.
Reade Mchry. Co., Cleveland, O.

Schools, Correspondence
Amer. School of Correspondence, Boston, Mass.
Consolidated Schools, N. Y. City.
International Correspond. Schools, Scranton, Pa.

Schools, Technical
Mich. College of Mines, Houghton, Mich.
Pratt Institute, Brooklyn, N. Y.

Screw Machines, Automatic
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Machine Screw Co., Cleveland, Ohio.
Dreses Mach. Tool Co., Cincin., O.
Windsor Mach. Co., Windsor, Vt.

Screw Machines, Hand
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Mch. Screw Co., Cleveland, O.
Garvin Mach. Co., New York.
Jones & Lamson Mch. Co., Springfield, Vt.
Pearson Mach. Co., Chicago, Ill.
Potter & Johnston Mach. Co., Pawtucket, R. I.
Pratt & Whitney Co., Hartford, Conn.
Warner & Swasey Co., Cleveland, Ohio.
Windsor Mach. Co., Windsor, Vt.

Screw Machinery, Wood and Lag
Baker Bros., Toledo, Ohio.
Cook Co., Asa S., Hartford, Conn.

Screw Plates
Besly & Co., Chas. H., Chicago, Ill.
Carpenter Tap & Die Co., J. M., Pawtucket, R. I.
Card Mfg. Co., S. W., Mansfield, Mass.
Hart Mfg. Co., Cleveland, O.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Oster Mfg. Co., Cleveland, O.
Wells Bros. Co., Greenfield, Mass.
Wiley & Russell Mfg. Co., Greenfield, Mass.

Separators, Oil
American Tool & Mch. Co., Boston, Mass.
Springfield Separator Co., Springfield, Vt.

Second Hand Machinery
Baird Machy. Co., U., Pittsburgh, Pa.
Bowler & Co., Geo. H., Cleveland, Ohio.
Carlin Mchry. & Supply Co., Allegeny, Pa.
Chicago House Wrecking Co., Chicago, Ill.
Dawson, John H., Chicago, Ill.
Dustin Co., Chas. E., New York.
Fairbanks Co., New York.
Fairbanks Co., Philadelphia, Pa.
Garvin Mch. Co., New York.
Hall's Sons, Sam'l, New York.
Hill, Clarke & Co., Boston, Mass.
Marshall & Huschart Mchry. Co., Chicago, Ill.
McCabe, J. J., New York.
Niles Tool Works Co., New York.
Osborn Mchry. Co., New Haven, Conn.
Pratt & Whitney Co., Hartford, Conn.
Prentiss Tool & Supply Co., New York.
Toomey, Frank, Philadelphia, Pa.
Wormer Machy. Co., C. C., Detroit, Mich.

Shafts, Crank
Standard Connecting Rod Co., Beaver Falls, Pa.

Shafts, Flexible
Chicago Flexible Shaft Co., Chicago, Ill.

Shapers
Amer. Tool Wks. Co., Cincin., O.
Bement, Miles & Co., New York.
Cincinnati Shaper Co., Cincin., O.
Flather Planer Co., Mark, Nashua, N. H.
Garvin Mach. Co., New York.
Hendey Mach. Co., Torrington, Ct.
Gould & Eberhardt, Newark, N. J.
Hill, Clarke & Co., Boston, Mass.
Kelly Co., R. A., Xenia, Ohio.
New Haven Mfg. Co., New Haven, Conn.
Niles Tool Works Co., New York.
Potter & Johnston Mach. Co., Pawtucket, R. I.
Steptoe & Co., John, Cincinnati, O.

Shears, Power
Bethlehem Fdry. & Mch. Co., So. Bethlehem, Pa.
Bliss Co., E. W., Brooklyn, N. Y.
Bremer Mach. & Tool Co., Kalamazoo, Mich.
Buffalo Forge Co., Buffalo, N. Y.
Cleveland Punch & Shear Works, Cleveland, O.
Hilles & Jones Co., Wilmington, Del.
Long & Allstatter Co., Hamilton, Ohio.
Pittsburgh Shear Knife & Mach. Co., Pittsburgh, Pa.
Reade Mchry. Co., Cleveland, O.

Shears, Rotary
Bethlehem Foundry & Mach. Co., So. Bethlehem, Pa.
Detrick & Harvey Mach. Co., Baltimore, Md.

Slide Rests
Bartlett Co., E. E., Boston, Mass.
Reed Co., F. E., Worcester, Mass.

Slotters
Baker Bros., Toledo, Ohio.
Bement, Miles & Co., New York
Betts Mach. Wks., Phila., Pa.
Franklin Mach. Wks., Phila., Pa.
Garvin Mach. Co., New York.
New Haven Mfg. Co., New Haven, Conn.
Newton Mach. Tool Wks., Philadelphia, Pa.
Niles Tool Works Co., New York.

Speed Limit System
Consolidated Engine Stop Co., New York.

Springs
Cleveland Wire Spring Co., Cleveland, O.

Sprocket Chains
See Driving Chains.

Stamps, Letters and Figures
Schwerdtle Stamp Co., Bridgeport, Conn.

Stampings, Sheet Steel
Automobile & Cycle Parts Co., Cleveland, O.

Steel, Machinery
International Steel & Mchry. Co., New York.
Patriarche & Bell, New York.
Ward & Son, Edgar T., Boston, Mass.

Steel, Sheet
Automobile & Cycle Parts Co., Cleveland, O.
Ward & Son, Edgar T., Boston, Mass.

Steel, Tool
International Steel & Mach. Co., New York.
Patriarche & Bell, New York.

Straightener, Hydraulic
Bement, Miles & Co., New York.
Watson-Stillman Co., New York.

Swaging Machines
Excelsior Needle Co., Torrington, Conn.

Switchboards
C & C Electric Co., New York.
Triumph Elec. Co., Cincinnati, O.

Taps, Collapsing
Geometric Drill Co., Westville, Ct.

Tapping Machines and Attachments
Baker Bros., Toledo, O.
The Beaman & Smith Co., Providence, R. I.
Bickford Drill & Tool Co., Cin., O.
Cincinnati Mach. Tool Co., Cincinnati, O.
Errington, F. A., N. Y. City.
Fosdick & Holloway Mach. Tool Co., Cincinnati, O.
Garvin Mach. Co., New York.
Geometric Drill Co., New York.
Geometric Drill Co., Westville, Ct.
Gould & Eberhardt, Newark, N. J.
Pratt & Whitney Co., Hartford, Conn.
Seneca Falls Mfg. Co., Seneca Falls, N. Y.
Webster & Perks Tool Co., Springfield, O.

Taps and Dies
Besly & Co., Chas. H., Chicago, Ill.
Card Mfg. Co., S. W., Mansfield, Mass.
Carpenter Tap & Die Co., J. M., Pawtucket, R. I.
Cleveland Twist Drill Co., Cleveland, O.
Crane Co., Chicago, Ill.
Hammacher, Schlemmer & Co., New York.
Hart Mfg. Co., Cleveland, O.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Oster Mfg. Co., Cleveland, O.
Pratt & Whitney Co., Hartford, Conn.
Standard Tool Co., Cleveland, O.
Wells Bros. Co., Greenfield, Mass.
Wiley & Russell Mfg. Co., Greenfield, Mass.

Telephone System
Clarke Auto. Telephone Switch Board Co., Providence, R. I.

Threading Dies, Opening
Errington, F. A., New York.
Geometric Drill Co., Westville, Ct.
Jones & Lamson Mch. Co., Springfield, Vt.
Pratt & Whitney Co., Hartford, Conn.

Thread Cutting Tools
Besly & Co., Chas. H., Chicago, Ill.
Hart Mfg. Co., The, Cleveland, O.
Oster Mfg. Co., Cleveland, O.
Pratt & Whitney Co., Hartford, Conn.
Rivett-Dock Co., Boston, Mass.

Tool Holders
Armstrong Bros. Tool Co., Chicago, Ill.

Tools
See Machinists' Small Tools.

Transmission Machinery
Allston Fdry. Co., Boston, Mass.
American Pulley Co., Phila., Pa.
Caldwell & Son Co., H. W., Chicago, Ill.
Cresson & Co., Geo. V., Phila., Pa.
Jones Fdry. & Mch. Co., W. A., Chicago, Ill.
Link-Belt Engineering Co., Philadelphia, Pa.
Patterson, Gottfried & Hunter, Ltd., New York.
Reeves Pulley Co., Columbus, Ind.

Trolleys and Tramways
Brown Hoisting Machy. Co., N. Y. City.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Hunt Co., C. W., West New Brighton, N. Y.
Link Belt Engineering Co., Philadelphia, Pa.
Maris Bros., Philadelphia, Pa.
Moyer & Co., J. W., Philadel., Pa.
Yale & Towne Mfg. Co., New York.

Traps, Steam
Houghton & Co., E. F., Philadelphia, Pa.

Trimmers, Wood
Amer. Mchry. Co., Grand Rapids, Mich.
Leland & Faulconer Mfg. Co., Detroit, Mich.
Washburn Shops, Worcester, Mass.

Turrets, Carriage
Fay & Scott, Detxer, Me.

Turret Machines
American Tool & Mach. Co., Boston, Mass.
Automatic Mach. Co., Greenfield, Mass.
Barker & Chard M. T. Co., Cin., O.
Bradford Mach. Tool Co., Cincinnati, O.
Brown & Sharpe Mfg. Co., Providence, R. I.
Bullard Mach. Tool Co., Bridgeport, Conn.
Cleveland Mach. Screw Co., Cleveland, O.
Dreses Mach. Tool Co., Cincin., O.
Flather & Co., Nashua, N. H.
Garvin Mach. Co., New York.
Gisholt Mch. Co., Madison, Wis.
Grant Tool Co., Franklin, Pa.
Hill, Clarke & Co., Boston, Mass.
Jones & Lamson Mch. Co., Springfield, Vt.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
Lodge & Shipley Mach. Tool Co., Cincinnati, O.
Niles Tool Works Co., New York.
Pearson Mach. Co., Chicago, Ill.
Potter & Johnston Mach. Co., Pawtucket, R. I.
Warner & Swasey Co., Cleveland, Ohio.
Windsor Mach. Co., Windsor, Vt.

Twist Drills
Cleveland Twist Drill Co., Cleveland, O.
Etna Mfg. Co., New York.
Hammacher, Schlemmer & Co., New York.
Morse Twist Drill & M. Co., New Bedford, Mass.
Standard Tool Co., Cleveland, O.

Universal Joints
Baush Machine Tool Co., Springfield, Mass.
Gray & Prior Mach. Co., Hartford, Conn.

Valves
See Steam Fittings.

Vises, Metal Workers'
Hammacher Schlemmer & Co., New York.
Howard Iron Wks., Buffalo, N. Y.
Parker Co., Chas., Meriden, Conn.
Walworth Mfg. Co., Boston, Mass.

Vises, Pipe
Curtis & Curtis Co., Bridgeport, Conn.
Saunders' Sons, D., Yonkers, N. Y.
Walworth Mfg. Co., Boston, Mass.

Vises, Planer and Shaper
Cincinnati Planer Co., Cincin., O.
Hendey Mach. Co., Torrington, Ct.
Pratt & Whitney Co., Hartford, Conn.

Vises, Wood Workers'
Hammacher, Schlemmer & Co., New York.
Wyman & Gordon, Worcester, Mass.

Welding Machines
Long & Allstatter Co., Hamilton, Ohio.

Wire-Forming Machinery
Automatic Mach. Co., Bridgeport, Conn.
Mossberg & Granville Mfg. Co., Providence, R. I.

Worm Hobbing Machines
Grant Tool Wks., Franklin, Pa.
Pratt & Whitney Co., Hartford, Conn.

Worm Milling Machines
Cleveland Mach. Screw Co., Cleveland, O.
Pratt & Whitney Co., Hartford, Conn.

Wrenches
Coes Wrench Co., Worcester, Mass.

Wrenches, Drop Forged
Billings & Spencer Co., Hartford, Conn.
Williams & Co., J. H., Brooklyn, N. Y.